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CONTRIBUTIONS TO A SOUTH INDIAN MARINE ALGAL FLORA—II.

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This second contribution to a South Indian Marine Algal Flora deals with a series of species found when I continued my examination of Professor IYENGAR'S comprehensive collection of Algæ from South India. In the first part, I have dealt with the brown and red algæ only, and the same is the case in this part also, as Professor IYENGAR intends to work out the other groups himself.

In order to compare several of the Indian specimens with those found in J. AGARDH'S famous herbarium, several visits to Lund in Sweden were necessary, and I am very much indebted to Dr. HULTÉN, Keeper of the Herbarium of the Botanical Museum in Lund, for permitting me to work there. I am also very grateful to Professor H. KYLIN for valuable suggestions regarding critical species. I wish to thank him most sincerely for his kind hospitality during my repeated visits to Lund.

For the final determination of several difficult species I went to London in the spring of 1936 in order to study the different species found in the rich herbaria of the Royal Botanic Gardens, Kew, and of the British Museum (Natural History). I cannot thank the officials of these institutions sufficiently enough for all their kindness and help during my visits to their herbaria and libraries.

I am much indebted to the Trustees of THE CARLSBERG FOUNDATION for a grant towards the cost of the travel.

Copenhagen in April 1937.

PHÆOPHYCEÆ

I. Ectocarpales.

Fam. 1. *Ectocarpaceæ.*

Ectocarpus Lyngb.

1. **Ectocarpus breviarticulatus** J. Ag., Nya alger fraan Mexico (Öfversigt af K. Vetensk.-Akad. Förhandl. 15. *Jan.,* 1847, p. 7). BOERGESEN, Mar. Alg. D. W. I., vol. I, p. 173, fig. 136, Copenhagen 1913-14. SETCHELL, *American* Samoa (Department of Marine Biology of the Carnegie Institution of Washington, vol. XX, 1924, p. 171, fig. 37).—*Ectocarpus hamatus* Cr., in MAZÉ et SCHRAMM, Essai de classif. Algues de la Guadeloupe, 2e Edit., 1870-77, p. 111. VICKERS, Phycologia Barbadensis, part II, pl. 29.

This characteristic species was at first found by LIEBMANN at St. Augustin on the pacific coast of Mexico, later on in the West Indies by MAZÉ and SCHRAMM, Mlle VICKERS and myself and finally by SETCHELL in American Samoa. Its occurrence at Madras, so far from its former areas of distribution is extremely interesting.

The plant from Madras Harbour was found "sticking to a stone in spray"—in surroundings quite similar to those of the West Indian plant—and formed low dense tufts about 2 cm. high. I compared it with the type material and found that it agreed very well with the original. The characteristic short roundish barrel-shaped plurilocular sporangia were about 55μ long and 45-50μ broad: the filaments had a breadth of 27-30μ. This species is also found at Mahabalipuram (The Seven Pagodas) south of Madras, which is a very exposed locality.

India: Madras Harbour, Sept. 1924, and Mahabalipuram, Jan. 1923, leg. M.O.P.I.

Distr.: West Indies, Mexico, American Samoa.

Fam. 2. *Encoeliaceæ.*

Colpomenia Derb. et Sol.

1. **Colpomenia sinuosa** (Roth) Derb. et Sol. Cfr. BOERGESEN, Some mar. Alg. Arabian Sea, p. 25.

Specimens with plurilocular sporangia are found in IYENGAR's collection.

India: Tuticorin, 2nd Jan. 1928, leg. M. O. P. I.

Distr.: *Widely spread in warm seas.*

Chnoospora J. Ag.

1. **Chnoospora fastigiata** J. Ag., Spec. Alg. I, 1848, p. 171. BARTON, E. S., On the fruit of *Chnoospora fastigiata* J. Ag. in Journ. Linn. Soc. 33, 1897-8, p. 507, pl. 28.

var. PACIFICA *J. Ag. 1-c. p. 172.*

Several specimens are found in IYENGAR's *collection. One of* these reached a height of about 25 cm. Others from the very *exposed locality, "The Seven Pagodas,"* South of *Madras*, are only about 6-10 cm. high. The specimens had plurilocular *sporangia.*

India: The Seven Pagodas, January *1922, and* Cape Comorin, Sept. 1924, leg. M. O. P. I.

Distr.: West Indies (var. ATLANTICA), Pacific Ocean, Japan, Australia, etc.

2. **Chnoospora implexa** (Her.) J. Ag., Spec., Alg. I, p. *172.* WEBER, *Algues du Siboga*, p. *137.*

A single dried specimen is found in IYENGAR's collection; it was not very suitable for anatomical examination, so I have not been able to see the *sporangia.*

The specimen seems to resemble those mentioned by Mme. Weber (l. c.) showing much likeness to KÜTZING's figure in Tabulæ Phycologicæ, vol. IX, tab. 28, fig. 2 of *Dictyota obtusangula* (=*Chnoospora obtusangula* (Harv.) Sonder), a form most probably to be referred to *Ch. implexa;* compare Mme. WEBER, l. c.

India: Tuticorin, 3rd Oct. *1923*, leg. M. O. P. I.

Distr.: Red Sea, Malayan Archipelago, Japan, etc.

II. Dictyotales.

Fam. 1. **Dictyotaceæ.**

Spathoglossum Kütz.

1. **Spathoglossum asperum** J. Ag., Analecta Algologica, Continuatio I, 1894, p. 36. BOERGESEN, F., List mar. Alg. Bombay, p. 35, pl. 5.

Some specimens agreeing very well with *those from* Bombay as well as with specimens found in the British Museum (Nat.

Hist.), London, were collected by IYENGAR and myself in different places in India. In IYENGAR's collection one specimen from Krusadi Island has a thallus with very irregularly dentate and sinuate margins from which large and small proliferations are given out. A specimen from Tuticorin rather like this plant is found in the Herbarium of the British Museum.

India: Karvar, Bengi Bay, Febr. 1928 (!); Tuticorin, Febr. 1928, M.O.P.I., (!); Pearl Bed, March 1928, M. O. P. I. Cape Comorin, Sept. 1926, M. O. P. I. Krusadi Island, Pamban. May 1929, M. O. P. I.

Distr.: Ceylon, India.

Zonaria J. Ag.

1. **Zonaria variegata** (Lamx.) Ag., Synopsis Alg., 1817, p. XX. For more literature compare BOERGESEN in Journ. Ind. Bot. Soc., vol. IX, 1930, p. 169.

India: Krusadi Island, Pamban, Oct. 1924, and Tuticorin, Oct. 1923, leg. M. O. P. I.

Distr.: Seems to occur in most warm seas.

2. **Zonaria latissima** Kütz., Tab. Phycol., vol. 9, p. 30, tab. 75, fig. 1.—Not *Zonaria Schimperi* (Ruch.) Kütz. to which species DE-TONI, Syll., III, p. 233, refers *Zonaria latissima* as a synonym though with a query.

A single but fine specimen in IYENGAR's collection agrees very well with KÜTZING's description. The plant is of a dark brown colour, 10 cm. high and about 13 cm. broad, flabelliform, deeply divided in several large and small lobes with attenuated-cuneate bases broadening abruptly near the middle into flabelliform or subreniform parts of variable breadth about 4-5 cm. broad with roundish even margins. The surface is concentrically zonate, and rather smooth, and the consistency firm and tough. The main stem is covered by brown rhizoids. A tangential transverse section of the reniform lobes shows that the thallus is composed of densely placed rows of cells containing about 9 cells in each row, these being about twice as broad as long with the exception of the cortical cells above and below which, being divided into two cells by vertical walls, are about as broad as long.

DE-TONI as said above refers *Zonaria latissima* to *Zonaria Schimperi* (Ruch.) Kütz., but the frond in this plant is described as "membranaceo-tenuissima" and KÜTZING's figures of the transverse sections of the thallus (Tab. Phycol., vol. 9, pl. 74) also show 4-5 cells with thin walls in the rows. A fine specimen of what I think to be *Zonaria Schimperi* from Ashrafi and Kaisum near the entrance of the Gulf of Suez in the Red Sea has been presented to me by a young Egyptian Algologist, Mr. A. H. NASR, during his stay in Copenhagen. It is a large plant about

20 cm. high and divided into several broad and narrow cuneate-sub-flabellate lobes. The thallus is thin, papery and brittle. It is of a yellowish brown colour with dark brown concentric zones formed at a distance of about 1 cm. between each zone. KÜTZING's figure quoted above is drawn from a defective specimen. As may be seen from the above description, this plant from the northern part of the Red Sea is quite different from *Zonaria latissima* Kütz.

In the Kew Herbarium, I saw a small specimen from Singapore which was determined by SETCHELL as *Zonaria latissima* Kütz. and which resembles the Indian plant very much. As regards the colour and the consistency of its thallus, *Zonaria latissima* Kütz. shows some likeness to *Zonaria nigrescens* Sonder from Australia, but the lobes in this species are more narrow.

India: Krusadi Island, leg. M. O. P. I. (no. 241), May, 1924.

Distr.: Red Sea, Singapore.

3. **Zonaria crenata** J. Ag., Till Algernes System., Lunds Univers. Aarsskr. t. IX, 1872, p. 48. WEBER VAN BOSSE, A., Algues Siboga, p. 175.

A single specimen preserved in formalin in IYENGAR's collection is, I think, referable to this species. The Indian specimen, like the ones found by Mme. WEBER in the Malayan Archipelago, resembles very much *Zonaria flava* (Clem.) Ag.

India: Tuticorin, Oct. 1924, leg. M. O. P. I.

Distr.: Malayan Archipelago, Australia.

Padina Adans.

1. **Padina tetrastromatica** Hauck, cfr. BOERGESEN in Journ. Ind. Bot. Soc., vol. IX, 1930, p. 172.

India: Tuticorin, 3rd Aug. 1923 and Cape Comorin, Sept. 1924, leg. M. O. P. I.

Distr.: Somaliland, Malayan Archipelago, Ceylon, India, China.

2. **Padina Commersonii** Bory. cfr. BOERGESEN, l.c., p. 170.

India: Krusadi Island, May 1924, leg. M. O. P. I.

Distr.: Arabian Sea, Malayan Archipelago, Ceylon, Mauritius, Tonga Island, Australia.

3. **Padina gymnospora** (Kütz.) Vickers, Liste Algues Barbade (Ann. Sc. Nat. Bot., Sér. 9. t. 1, 1905, p. 58); Phycologia Barbadensis, pl. VII. BOERGESEN, l.c., p. 170.

India: Pamban, Oct. 1921, leg. M. O. P. I.

Distr.: West Indies, Malayan Archipelago, India, Australia, etc.

Dictyopteris Lamx.

1. **Dictyopteris delicatula** Lamx. in Journ. Philom., 1809, no 20, tab. 6, fig. *B.*—*Haliseris delicatula* C. Ag., Spec., p. 144. J. AGARDH, Spec., Alg., vol. I, p. 116. KÜTZING, Tab. Phycol., vol. IX, pl. 56, fig. 1.

Several specimens are to be found in IYENGAR'S collection.

India: Tuticorin, Febr. 1928, M. O. P. I., (!); Cape Comorin, Oct. 1924, M. O. P. I.; Pamban, 1921, M. O. P. I.

Distr.: West Indies, Brazil, Malayan Archipelago.

1. **Dictyopteris Woodwardii** (Brown) J. Ag., Spec. I, p. 116. KÜTZING, Tab. Phyc., vol. IX, tab. 53, fig. II. *Fucus Woodwardii* Brown in TURNER, Fuci, tab. 158.

From Malvan I have seen a fruiting specimen which had the dentate margin characteristic of this species. The groups of hairs in the young parts of the thallus are found in a row on both sides of the midrib at a distance of about 1/3 of the breadth of half of the lamina; this is also easily seen in TURNER'S fine figure. The fructiferous organs form a narrow belt close to the midrib on both sides of it.

To this species is referable too, in my opinion, a specimen from Krusadi Island in South India. Its margin is undulating and provided with teeth and the groups of hairs are arranged in the same way as in the specimen mentioned above. It is sterile.

India: Malvan, March 15, 1928, leg. S. C. DIXIT. Krusadi Island, Sandy Point, March 1928, leg. M. O. P. I.

Distr.: Australia, China.

3. **Dictyopteris Muelleri** (Sond.) Web. v. Bosse, Algues Siboga, p. 181.—*Haliseris Muelleri* Sonder in Linnæa, vol. 25, p. 665. J. AGARDH, Till Alg. System. V, p. 132. HARVEY, Phycol. austr., tab. 180. KÜTZING, Tab. Phyc., vol. 9, tab. 56, I.

Two small sterile specimens appear to be referable to this species. As regards the ramification and shape of the frond, they agree very well with KÜTZING'S figure and have the small groups of hairs scattered over the whole surface of the thallus. But as they are young and sterile, the determination is of course not quite certain. Mme. WEBER found some sterile specimens in the Malayan Archipelago.

India: Tuticorin, dredged near Hare Island in about 2-4 fathoms of dirty water, 1-3-1928, (!).

Distr.: Australia, Malayan Archipelago.

Dictyota Lamx.

1. **Dictyota maxima** Zan., Phycearum indicarum pugillus in Memor. del. R. Istituto, vol. XVII, Venetiis 1872, p. 4, no 12, pl. I, fig. 1-3.

I have not been able to compare my specimens with authentic material, but in the Kew Herbarium I have seen some specimens from Ceylon referred to this species, and they resemble mine very much.

In a small collection of algæ from South India collected by Dr. E. K. Janaki Ammal and Dr. C. E. Erlanson and sent to me for determination by Professor W. R. Taylor, Ann Arbor, Michigan, I found a large fine specimen which I think is referable to this species. It agrees very well with the description and figure given by Zanardini. It differs only in one respect. The margins are more or less provided with small teeth. The specimen is fertile, the tetrasporangia being spread over the whole thallus.

India: Tuticorin dredged at 3-4 fathoms of water near Hare Island (!); Karvar: Bengi Bay, (!); Krusadi Island 23-6-1932, leg. E. K. Janaki Ammal.

Distr.: Sarawak.

III. Fucales.

Fam. I. ***Fucaceæ.***

Hormophysa Kütz.

1. **Hormophysa triquetra** (L.) Kütz., Phycologia generalis, p. 359. Setchell, W. A., Some marine plants from South Eastern Melanesia (Proceedings of the California Academy of Sciences, 4th series, vol. 21, 1935, p. 264).—*Fucus articulatus* Forssk., Flora Ægpyptiaco-Arabica, p. 191. For more synonyms compare De-Toni, Sylloge Algarum, vol. III, p. 176: *Cystoseira triquetra, Cystoseira prolifera* and *Cystoseira latifrons* and p. 188: *Hormosira? articulata.*

The synonomy of this species is very complicated, due evidently to the investigators having had only very poor material. Thus the type-specimen of *Fucus articulatus* found in Forsskaal's herbarium in the Botanical Museum, Copenhagen, is a small fragmentary piece composed only of seriated vesicles in agreement with the specific name of Forsskaal. The specimen was evidently lying near the shore for some time, where it must have been battered about and worn and bleached. Because of this and because, when working out our Forsskaal's algæ, I was quite without suitable material to compare it with, I gave up the determination and allowed it to retain the name it has in Sylloge Algarum[1]. But last winter, in Professor Iyengar's

[1] Boergesen, F., A revision of Forsskaal's Algæ, etc. in Dansk Botanisk Arkiv, vol. 8, 1932, Nr. 2, p. 11.

collection, I came across some well preserved specimens of *Hormophysa triquetra*, and, while examining these, my attention was once more turned to FORSSKAAL's plant. Therefore, when some time after, in the spring of 1936, I visited the British Museum (Nat. Hist.), London, where I knew that some of FORSSKAAL's algæ are kept, I asked Dr. TANDY if a specimen of *Fucus articulatus* was to be found there. There was a specimen in the Museum! The specimen was much larger and more complete than the one found in Copenhagen, so that there was no doubt at all about its belonging to *Hormophysa*. But as of course it would be of much interest to find in the Red Sea some specimens showing a likeness to the fragment found in Herb. FORSSKAAL, I asked Mr. NASR during his stay here in Copenhagen, to send me some material of *Hormophysa* and especially to try to find some specimens resembling the one from which the fragment in FORSSKAAL's herbarium must be presumed to have originated. Mr. NASR, most kindly sent me several specimens of various shapes: one broad form resembling KÜTZING'S figures in Tabulæ Phycologicæ, vol. X, pl. 60, II and pl. 61, named *Hormophysa latifrons* and *Hormophysa articulata* respectively and a narrow-leaved one resembling KÜTZING'S figure of *Hormophysa triquetra* on pl. 60, I. The last mentioned slender form has often long rows of vesicles in the upper branches, and when a piece of such a specimen is cast ashore and worn by the waves it will certainly become quite like FORSSKAAL's specimen.

The Indian specimens in IYENGAR'S collection resemble in shape KÜTZING's figures pl. 60, II and pl. 61 named *Hormophysa latifrons* and *H. articulata* respectively. But, as pointed out by Mme. WEBER, Algues Siboga, p. 148, these two species are identical and are, as done by SETCHELL (l.c.), to be considered broad-leaved forms of *Hormophysa triquetra* (L.) Kütz. (=*Fucus triqueter* L.) which species also includes *Fucus articulatus* Forssk.

India: Krusadi Island, Pamban, 24th Apr. 1924, leg. M.O.P.I.

Distr.: Red Sea, Malayan Archipelago, Australia, etc.

Cystophyllum J. Ag.

1. Cystophyllum muricatum (Turn.) J. Ag., Spec. Alg. I, p. 231.—*Fucus muricatus*, Turner, Fuci, p. 107, pl. 112. For more literature comp. DE-TONI, Syll. Alg., III, p. 154.

India: Krusadi Island, Pamban, May 1924 and October 1924, leg. M.O.P.I.

Distr.: Persian Bay, Arabian Sea, South India, Malayan Archipelago, Australia.

RHODOPHYCEÆ

A. Bangiales.

Fam. 1. Bangiaceæ.

Porphyra C. *Agardh.*

1. **Porphyra tenera** *Kjellm. Japanske Arter af Slägtet Porphyra*, p. 20, tab. I, fig. 6; tab. 4, figs. 2-5; tab. 5, figs. 22-26. YENDO, Notes on *Algæ* new to Japan *IV*, p. *52-4* (in *Bot. Mag.* 30). ISHIKAWA, Cytological studies on *Porphyra tenera* (Bot. Mag., 35, p. 206, pl. IV). OKAMURA, ONDA and HIGASHI, Preliminary notes on the development of the carpospores of *Porphyra tenera* Kjellm. (Bot. Mag. 34, p. 131). C. K. TSENG, Economic seaweeds of Kvantung Province. S. China (Lingnan Science Journ., vol. 14, 1935, p. 99, pl. 1, fig. 2).

Some dried specimens in IYENGAR's collection seem to be *referable to this species. I have been able to compare the Indian* plant with some Japanese ones from Goi, prov. Kazusa, collected by YAMADA and with these the *Indian ones agree very well*. The specimens are elongated linear with broad bases reaching a length of about *25* cm. and with sinuated undulated margins. They agree quite well with TSENG's above quoted figure. The colour is greyish-purple. In the upper ends some of the specimens were fructiferous. The thallus is thin and adheres well to paper.

India: Madras Harbour, January 18th 1926, leg. M.O.P.I.

Distr.: Japan, China.

Erythrocladia Rosenv.

1. **Erythrocladia subintegra** Rosenv., Mar. Alg. of Denm. Vol. I, Rhodophyceæ, p. *73*, figs. 13-14. BOERGESEN, Mar. Alg. D.W.I., vol. II, p. 7, figs. 3-4. KYLIN, Mar. Red Algæ vicinity *Biol. Station at Friday* Harbor, Wash. (Lunds Univ. Aarsskrift; N.F. Avd. 2, Bd. 21, nr. 9, 1925, p. 9, fig. 3 c-g.)

Well developed specimens with sporangia were found upon *Chætomorpha media*.

India: Mahabalipuram *(The Seven-Pagodas) South of* Madras, Jan. 1923, leg. M.O.P.I.

Distr.: Seems to be widely spread.

B. Florideæ.

I. Nemalionales.

Fam. 1. ***Helminthocladiaceæ.***

Sub-fam. 1. ***Nemalieæ.***

Liagora Lamx.

Liagora ceranoides Lamx., Hist. Polyp. corallig. flex., 1816, p. 239. HOWE, M. A., Algæ, in Britton and Millspough. The Bahama Flora, p. 555, 1920. BOERGESEN, F., Algæ from the Canary Islands, p. 58, 1927.—*Liagora pulverulenta* Ag., Spec. Alg., vol. I, 1821, p. 396. BOERGESEN, F., Mar. Alg. D.W.I., vol. II, p. 80-85, figs. 87-92.

A few specimens are found in IYENGAR's collection. The cystocarps agreed very well with my figure 90 d in the paper quoted above. Only a few carpogonial branches were found in the material. They were not so much curved as in the West Indian plant.

India: Mandapam, Oct. 1925, leg. M.O.P.I.

Distr.: India, Malayan Archipelago, Red Sea, West Indies, etc.

Sub-fam. 2. ***Dermonemeæ.***

Dermonema (Grev.) Schmitz.

1. Dormonema gracile(Mart.)Schmitz, in Heydrich, Algenfl. Ost-Asien (Hedwigia, 33, 1894, p. 289). WEBER VAN BOSSE, Alg. Siboga, p. 204.—*Gymnophloea gracilis* Martens, Tange d. Preuss. Exp. n. Ost-Asien, 1866, p. 146. KÜTZING, Tab. Phycol. vol. 17, tab. 1 (KÜTZING says that his plant is from "Nova Caledonia." As pointed out by Mme. WEBER, this is a mistake; the specimen in his herbarium originates from Galle, Ceylon). *Dermonema dichotomum* Harv., Alg. Ceyl. no 93. HEYDRICH l. c.

HEYDRICH l. c. gives a description of the plant accompanied by some figures. In the material examined by me I found only the carpogonial branch; it is composed of 3 cells.

The gonimoblastic filaments described by SCHMITZ in ENGLER und PRANTL, Nat. Pflanzenf. I, 2, p. 335, fig. 205, were not found.

The plant was quite infected with *Ectocarpus Dermonematis*.

India.: Cape Comorin, Sept. 1924, leg M.O.P.I.

Distr.: Ceylon, Formosa, N. Guinea.

Fam. 2. ***Chætangiaceæ.***

Actinotrichia Decsne.

1. Actinotrichia fragilis (Forssk.) Boergs., A revision of Forsskaal's Algæ (Dansk Bot. Arkiv, Bd. 8, 1932, p. 6., pl. I, fig. 4).—*Fucus fragilis* Forssk., l.c., p. 190. *Actinotrichia rigida* (Lamx.) Decsne, Sur les Corallines in Ann. sc. nat., II sér., Bot., vol. 18, 1842, p. 118.

Some small specimens are found in IYENGAR'S collection.

India: Krusadi Island, Pamban, April 1924 and May 2, 1926, leg. M. O. P. I.

Distr.: Red Sea, Indian and Pacific Oceans.

II. Gelidiales.

Fam. 1. ***Gelidiaceæ.***

Gelidiopsis Schmitz.

1. Gelidiopsis variabilis (Grev.) Schmitz in ENGLER'S Bot. Jahrb., vol. 21, 1895-6, p. 148. FELDMANN, J. in Recueil de Travaux Cryptogamiques dédiés à LOUIS MANGIN, Paris 1931, p. 156.—*Gelidium variabile* (Grev.) J. Ag., Spec. Alg., II, p. 468. KÜTZING, Tab. Phyc., vol. 19, tab. 23 c.d. *Gigartina variabilis* Grev. mscr. in Hb. HOOKERI.

The Indian plant looks very much like HARVEY'S specimen in his Ceylon Algæ exsicc. no 33, and also agrees very well with KÜTZING'S figure quoted above, only it is somewhat smaller. A transverse section of both HARVEY'S and of the Indian plant (dried material) shows the circumference to be oval, indicating that the thallus most probably is not quite terete but somewhat compressed.

India: Cape Comorin, Sept. 1924 and Karwar, Febr. 1928, leg. M. O. P. I.

Distr.: Indian Ocean.

2. Gelidiopsis repens (Kütz.) Schmitz in ENGLER'S Bot. Jahrb., XVI, 1895, p. 148. WEBER VAN BOSSE, Alg. Siboga, p.425.—*Gelidium repens* Kütz., Tab. Phycol., Vol. 18, 1868, pl.60. *Gelidium acrocarpum* Harv., Alg. Ceylon no 34 (nomen nudum). KÜTZING, Tab. Phycol., vol. 19, 1869, pl. 23. J. AGARDH, Spec. Alg. vol. III, 1876, p. 552.

A single specimen is found in IYENGAR'S collection. It shows the very characteristic feature of this species as pointed out in AGARDH'S description: in the upwardly flattened and

dichotomous-flabellate thallus; the apices of the segments are either broadly rounded or acute. I have compared the Indian specimen with Harvey's above mentioned one from Ceylon as well as with some specimens collected by me near Galle.

India: Tuticorin, March 3rd, 1928, leg. M. O. P. I.

Distr.: Indian and Pacific Oceans.

III. Cryptonemiales.

Fam. 1. ***Rhizophyllidaceæ.***

Chondrococcus Kütz.

1. **Chondrococcus Hornemanni** (Mert.) Schmitz in ENGLER Bot. Jahrb. XXI, p. 170 (1895). BOERGESEN in Kew Bull. 1933, no 3, p. 117.—*Fucus Hornemanni* Mert., in Göttinger Gel. Anzeiger, no 64 (1815). *Desmia Hornemanni* Lyngb., Hydrophytolog. Dan. p. 35, tab. 7 C, 1819.

Tetrasporic specimens were found in IYENGAR'S collection. The sporangia form irregularly shaped expansions on the lobes of the thallus. They are divided transversely by oblique walls.

India: Tuticorin, Cape Comorin, Pamban, leg. M. O. P. I.

Distr.: Indian Ocean.

Fam. 2. ***Corallinaceæ.***

Amphiroa Lamx.

1. **Amphiroa anceps** (Lamk.) Decne., Sur les Corallines (Ann. Sc. Nat. 2 sér., Bot., t. 18, p. 125). Harvey, Nereis Australis, p. 98, tab. 37. WEBER VAN BOSSE and M. FOSLIE, The Corallinaceæ of the Siboga Exp., p. 93.—*Corallina anceps* Lamk., Mém. du Muséum, p. 238 (1815).

A form resembling very much HARVEY'S figure quoted above is found in a collection of Indian Algæ belonging to the British Museum and in IYENGAR'S collection preserved in formalin. The uppermost joints are thin and almost cylindrical.

India: Cape Comorin, Sept. 1920 and Oct. 1924, leg. M. O. P. I.

Distr.: India, South Africa, Malayan Archipelago, Japan, West Australia.

Fam. 3. **Grateloupiaceæ.**

Corynomorpha J. Ag.

1. **Corynomorpha prismatica** J. Ag., Florideernes Systematik, 1870 (Lunds Univ. Aarsskr. VIII) p. 3-4. Epicrisis, p. 142-3.—*Acrotylus prismaticus* J. Ag., Spec. II, p. 193. *Dumontia prismatica* J. Ag., Symbolæ in Linnæa, 15, p. 19. *Gymnophloea prismatica* Kütz., Spec. Alg., p. 711 ; Tab. Phycol., vol. 16, pl. 58.

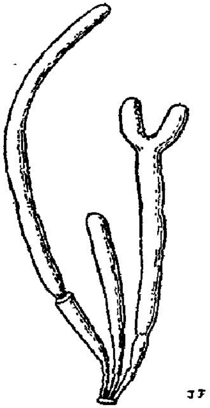

Fig. 1.—*Corynomorpha prismatica* J. Ag. Some young specimens. Natural size.

Only a few sterile specimens are found in Iyengar's collection. The plant grows in dense tufts, small young specimens being developed from the basal disc. The largest specimen was about 7 cm. high. One of the larger specimens had several concentric swellings near the base; I presume that the plant is perennial and that these swellings are due to the fact that during the unfavourable season of the year the plant dies down to its base and recommences its growth, when conditions become more favourable. In one specimen two filaments were developed from such a swelling. In the dêscription of the plant, it is said: "Frondes simplicissimæ," but, besides the above mentioned specimen, I have seen in the British Museum in London a specimen of Ferguson's Alg. Ceylon without any number and un-

determined but quite like the Indian plant. Several of the specimens in this collection were divided. (Compare also Fig. 1.)

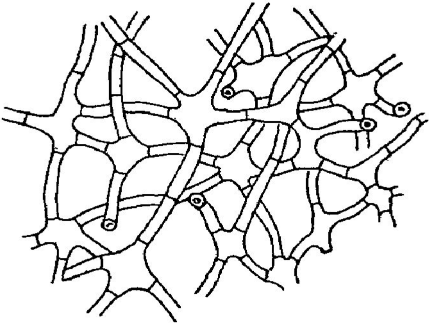

Fig. 2.—*Corynomorpha prismatica* J. Ag. Transverse section of medullary layer showing stellate cells. × 400.

A transverse section of the thallus of a specimen preserved in formalin shows that the interior of the thallus is composed of a very fine tissue of stellate cells forming larger meshes in the middle of the thallus and smaller ones towards the periphery (Fig. 2). This tissue is surrounded by a cortical layer which is composed of dichotomously divided short filaments, the cells of which become smaller and oblong at the periphery, where they are placed very close together.

India: Cape Comorin, Sept. 1924, leg. M. O. P. I.

Distr.: India, Ceylon, East Africa.

Cryptonemia J. Ag.

1. Cryptonemia Lomation (Bertol.) J. Ag., Spec. Alg. vol. II, p. 227; Epicr. p. 165. HAUCK, Meeresalgen, p. 130. WEBER VAN BOSSE, Algues Siboga, p. 248.—*Fucus Lomation* Bertolini, Opusc. Bol. II, p. 289, t. 10, fig. 3 (after De-Toni); Amoenitates Italicæ, 1819, p. 289, tab. 4, fig. 3. *Euhymenia Lactuca* Kütz., Spec. Alg., p. 741; Tab. Phycol. XVII, tab. 71.

A few specimens belonging to IYENGAR's collection and preserved in formalin seem referable to this species. The specimens are sterile about 3—4 cm. high with no central nerve. Most of the new leaves are given out from the edges of the older ones, but some also from the base of the former leaf as found by MME. WEBER, l. c. The thallus is about 100 μ thick. The larger specimens are rather like KÜTZING's figure quoted above.

India: Krusadi Island, 28th April 1924, "sticking to corals", M. O. P. I.

Distr.: Mediterranean Sea, Malayan Archipelago.

2. Cryptonemia coriacea Schmitz, Mar. Florideen von Deutsch-Ostafrika (ENGLER's Bot. Jahrb., 21, 1895, p. 166).

Although I have never seen any type-specimen of this species and know it only from SCHMITZ's description, I assume some small specimens in IYENGAR's collection to be most probably referable to this species.

After a fresh examination, I believe that the very large specimens from Karachi which, in Kew Bulletin 1932, p. 127, I have referred to *Cryptonemia undulata* Sonder also belongs most certainly to SCHMITZ's species, since they agree with his description. But, as mentioned above, I have not been able to compare the specimens with authentic material. On the other hand, the specimens from Dwarka and Okha Port mentioned also in the same number of the Kew Bulletin are a much smaller, more delicate plant with a very much undulated thallus and resembling so very much KÜTZING's figure in Tab. Phycologicae vol. 19, tab. 31, that I think it is quite right to refer them to SONDER's species.

India: Cape Comorin, Sept. 1924, leg. M. O. P. I.

Distr.: Kikogwe (East Africa), Karachi.

Carpopeltis Schmitz.

1. Carpopeltis rigida (Harv.) Schmitz in ENGLER's Bot. Jahrb., 26, 1895, p. 157. WEBER v. BOSSE, Alg. Siboga, p. 246, OKAMURA, Icones Jap. Algae, vol. II, p. 63, pl. 66.—*Cryptonemia rigida* Harv., Alg. Ceylon no 51.

A cystocarpic specimen is found in IYENGAR's collection.

India: Tuticorin, March 1928, M. O. P. I.

Distr.: East Coast of Africa, Ceylon, Malayan Archipelago, Japan.

IV. Gigartinales.

Fam. I. *Solieriaceæ.*

Solieria J. Ag.

1. Solieria robusta (Grev.) Kylin, Florideenordnung *Gigartinales*. (Lunds Universitets Aarsskrift., N. F., Avd. 2, Bd. 28, 1932, p. 18).—*Rhabdonia robusta* J. Agardh, Spec. Alg. 2, 355. BOERGESEN, in Kew Bulletin, 1934, p. 10.

forma WIGHTII J. Agardh, l. c., p. 355. KYLIN, l. c., p. 20, tab. 5, fig. 10.

A single specimen is found in IYENGAR's collection.

India: Tuticorin, Pearl Bed, March 2nd 1928, leg. M. O. P. I.

Distr.: Australia, Japan, Malayan Archipelago.

Sarconema Zanard.

1. **Sarconema indicum** (J. Ag.) Kylin, Die Florideenordnung *Gigartinales* (Lunds Universitets Aarsskrift, N. F. Avd. 2, Bd. 28, no 8, Lund 1932, p. 22, tab. 8, fig. 17).—*Solieria indica* J. Ag., Spec. Alg., p. 723.

A small sterile specimen agreeing very well with the original specimen in J. AGARDH's herbarium according to KYLIN's figure is found in IYENGAR's collection.

India: Cape Comorin, Sept. 1920, leg. M. O. P. I.

Distr.: India.

Fam. 2. *Hypneaceae.*

Hypnea Lamx.

1. **Hypnea pannosa** J. Ag., Alg. Liebm., p. 14; Spec. Alg., II, p. 453; Epicrisis, p. 565. KÜTZING, Tab. Phyc. vol. XVIII, tab. 27.

I compared the Indian specimen with LIEBMANN's original material determined by J. AGARDH, and found that they agreed very well, only the thallus of the Indian plant was a little broader. Specimens with tetrasporangia were found in February.

India: Karvar, Febr. 1928, (!); Tuticorin, Febr. 1928, (!); Cape Comorin, Oct. 1924, leg., M. O. P. I.

Distr.: Pacific and Indian Oceans.

Fam. 3. *Sarcodiaceae.*

Sarcodia J. Ag.

1. **Sarcodia ceylonensis** (J. Ag.) Kylin, Die Florideenordnung *Gigartinales* (Lund's Universitets Aarsskrift. N. F., Avd. 2, vol. 28, no 8, p. 56, pl. 21, fig. 52).—*Carpococcus ceylonensis* J. Ag., Analecta Algologica, Contin. V, 1899, p. 46.

The female but fragmentary specimens seen by me seem to agree perfectly well with KYLIN's above quoted figure of the original specimens in AGARDH's Herbarium. The plant has a thick very irregularly shaped thallus along the margins and on the flat sides of which the cystocarps are developed in great profusion. The cystocarps protrude much and are subglobular in shape. As mentioned by KYLIN, a transverse section of a cystocarp does not show a large fused cell. In the middle of the gonimoblasts a tissue of small cells is found.

The anatomy of the thallus agrees very well with that of *Sarcodia ceylanica.* At the periphery is found a cortical layer of very small cells arranged in vertical rows and below this is a tissue of cells growing larger and stellate inwards. In the middle there is a medullary tissue of filaments.

India: Cape Comorin, Oct. 1924, leg. M. O. P. I.

Distr.: Ceylon.

Fam. 4. **Gracilariaceæ.**

Gracilaria. Grev.

1. **Gracilaria lichenoides** (L.) Harv. in Lond. Journ. III, p. 445. J. AGARDH, Spec. Alg. II, p. 588; Epicrisis p. 412. TURNER, Fuci, tab. 118.

Compared with the small peripheral cells, the cells of the medullary tissue are very large which is the characteristic feature of this plant and which makes the thallus collapse when dried.

The appearance and ramification of the Indian plants resemble to a great degree TURNER'S figure quoted above. The cystocarps are scattered, much protruded and semi-globose.

India: Tuticorin, 29th February 1928 (!), M. O. P. I. Krusadi Island, Pamban, Oct. 1922, M. O. P. I.

Distr.: Indian and Pacific Oceans.

2. **Gracilaria pygmæa** nov. sp. Frons nana, ca. 4 cm. alta, plana, linearis, subcartilaginea, fastigiata, irregulariter *dichotoma vel polytoma. Thallus ca ¾-1¼ mm. latus et ca 400 µ* crassus. Cystocarpia per totam frondem sparsa.

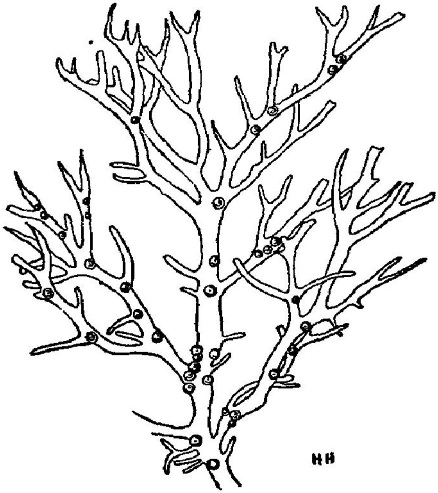

Fig. 3.—*Gracilaria pygmæa* Boergs. Habit of a female plant. × 3.

India: Krusadi Island, April 1924, leg. M. O. P. I.

This fine little *Gracilaria* (Fig. 3) forms a much ramified low tuft about 4 cm. high. The thallus is irregularly divided from

near the base. The branches are given out from the edges of the flat thallus either alternately or 2-3 seriately from the same side, the upper parts thus getting an antler-like appearance. The thallus is about ¾-1¼ mm. broad and about 400 μ thick. Only a female specimen was found. The cystocarps occur scattered on the flat side of the thallus, and are semispherical in shape and protrude much. Fig. 4 shows a transverse section of a ripe cystocarp with the parenchymatous tissue in the middle so characteristic of *Gracilaria*. The transverse section of the thallus is that

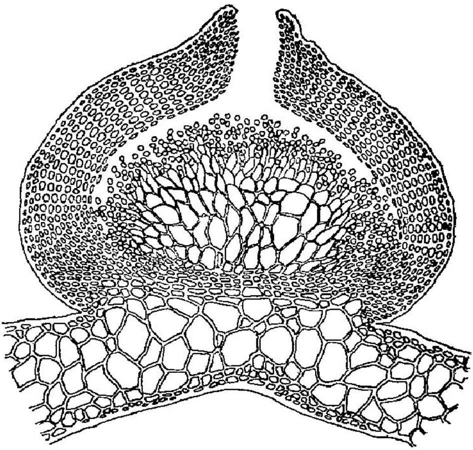

Fig. 4.—*Gracilaria pygmæa* Boergs. Transverse section of a cystocarp. × 50.

generally found in *Gracilaria* with a medullary tissue composed of large roundish cells covered by a thin layer of small cortical cells. The large cells have a diameter of about 100 μ. On account of its small size this plant is easily distinguished from all hitherto known species.

Corallopsis Grev.

Corallopsis opuntia J. Ag., Epicrisis, p. 409.—*Corallopsis cacalia?* Harvey, Alg. Ceylon no. 30.

In a paper on Ceylon marine Algæ (in the Ceylon Journal of Science, Section A, Botany, vol. XII, part 2, Colombo 1936, p. 86) I have referred some material resembling HARVEY'S plant no. 30 to *Gracilaria crassa* (Harv.) J. Ag. I did so because I had collected the material together with *Gracilaria crassa* in

the same locality. And, when I collected it, I was of opinion that it belonged to *Gracilaria crassa*, the somewhat thinner and more irregularly developed thallus of the specimens being due to the fact that these specimens were growing a little outside the optimum for the occurrence of this species. This supposition is quite probably correct. But, in order to be certain about it, a fresh examination is necessary. And, as in my Indian material I have now some material agreeing with HARVEY'S specimens of *Corallopsis opuntia* J. Ag. (Ceylon Alg. no 30) but not resembling *Gracilaria crassa*, I prefer to call them as I have done above.* I do so also because I 'have received from DR. C. K. TSENG, Shantung, China, two small specimens of a related form which have more regularly articulated thalli. These specimens seem to be quite like a plant which Mme. WEBER, in Algues de I' Expétition danoise aux Iles Kei (Vidensk. Medd. fra Dansk naturh Forening, Bd. 81, 1926, p. 145) refers to *Corallopsis Salicornia* var. *minor* Sond. according to the fine material found here in the Botanical Museum. In the lowermost part of these specimens the thallus is more or less cylindrical but higher up is much articulated. They seem to grow quite in the same manner as *Gracilaria crassa* and *Corallopsis opuntia* having arch-shaped, downwardly bent branches which when they touch rocks or other suitable substrata become fixed to these thus forming firm, dense cushions on the rocks. I feel much inclined to consider both DR. TSENG'S specimens and those from the Kei Island to be more articulated and better developed specimens of *Corallopsis opuntia* than those collected by HARVEY (Ceyl. Alg. no 30) on which J. AGARDH based this species.

India: Tuticorin.

Distr.: Ceylon, Malayan Archipelago.

Fam. 5. **Phyllophoraceæ.**

Gymnogongrus Mart.

1. Gymnogongrus pygmæus (Grev.) J. Ag., Spec. Alg., II, p. 317; Epicrisis, p. 209. KÜTZING, Tab. Phyc., vol. XIX, tab. 64.—*Chondrus pygmæus* Grev., M. S. in Hb. HOOKER.

Female specimens were gathered by IYENGAR in February.

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*During a visit to Lund I was able to examine the specimens of HARVEY'S Ceylon Alg. no 30 found in J. AGARDH'S Herbarium. Three specimens are found. Two of these are quite like the one found in the Botanical Museum, Copenhagen, the lower part of the thallus being more or less cylindrical and subdichotomously divided, having higher up here and there an articulated pear-like thallus. The third specimen (also no 30) is a bleached specimen which most probably had been cast ashore. Its thallus is somewhat more robust. The lower parts of the thallus are cylindrical, on which some pear-like segments occur, these again being crowned by some flat prolongations.

The cystocarps form protuberances on the thallus ; they are proportionally large with a great number of carpospores arranged in groups surrounded by rhizoid-like filaments imbedded in slime.

India: Tuticorin, Hare Island, Cape Comorin, leg. M.O.P.I

Distr.: India, Ceylon, Japan.

V. Rhodymeniales.

Fam. 1. ***Champiaceæ.***

Champia Desvaux.

1. **Champia parvula** (Ag.) Harv., Nereis Bor. Am., vol. II, p. 76.—*Chondria parvula* Ag., Systema algarum, p. 207.

Some sterile specimens are found in IYENGAR's collection. Breadth of the filaments ca 1 mm.

India: Tuticorin (Hare Island), March 1928, leg. M.O.P.I., (!); Krusadi Island, Pamban, Oct. 1924, leg. M. O. P. I.

Distr.: Most warm seas.

2. **Champia globulifera** nov. spec.

Frons caespitosa, ca 6 cm. alta et ultra (?), cylindracea, articulata et moniliformis, paniculatim ramosa. Rami oppositi aut verticillati aut singuli, ad basin contracti ad apicem versus leniter attenuati, apicibus obtusi, novos ramulos emittentes. Thallus in ramis principalibus ca 2 mm., in ramulis ca $1\frac{1}{4}$-$1\frac{1}{2}$ mm. latus, in sectione transversale ex stratis duobus cellularum compositus. Articuli ventricosi, diametro subaequales aut in superiore parte ramorum paullulum breviores.

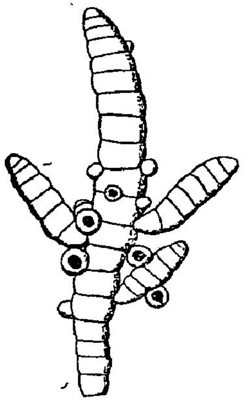

Fig. 5.—*Champia globulifera* Boergs. Part of a female plant with cystocarps. × 5.

Cystocarpia globose-urceolata, permagna, ca 1 mm. longa et lata in ramis ramulisque sparsa. Tetrasporangia in ramis sparsa.

India: Pamban, Oct. 1924, leg. M. O. P. I.

The largest specimens seen by me reach a height of about 6 cm. The plant forms dense tufts, as several shoots issue from the basal disc, and decumbent branches are able to form new discs, thus giving rise to new tufts (Fig. 6). The plant is monopodial in growth, and the branches are given out in all directions. They are either solitary or often opposite or verticillate, and they are ramified again in the same way but to a less extent. The main shoots reach a breadth of about 2 mm., but the branches are a little less broad. The branches are narrowed at their base and taper slowly towards their upper ends. The apex is obtuse. The plant is clearly constricted at the diaphragms, the segments becoming barrel-shaped and about as long as broad, but becoming gradually shorter upwards (Fig. 5).

A transverse section (Fig. 7 c) shows that the wall is composed of two layers of cells, the large cells of the wall becoming covered more or less completely by a cortical layer composed of rather large cells.

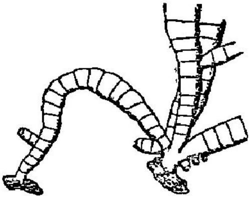

Fig. 6.—*Champia globulifera* Boergs. Base of a plant. Compare the text. × 4.

The cystocarps are nearly globose (Fig. 7a.) and rather large and measure about 1 mm. long and 1 mm. broad. They occur scattered on the thallus though often with a tendency to place themselves in small groups round the constrictions. The tetrasporangia are found scattered in the walls of the branches.

The Indian plant in size and shape appears to be related to the West Indian *Champia salicornoides*, but, when examined more carefully, several characters are found by means of which it can be distinguished from the latter. Thus the wall in the West Indian plant (at any rate in the plant I have referred to *Champia salicornoides*, compare my description in Mar. Alg. D. W. I., vol. II, p. 409, figs. 393-4) has only one layer of large cells. Another character is the shape of the cystocarps which in *Champia salicornoides* are elongated urceolate becoming much narrowed up-

wards. The figure (Fig. 7b) shows such a cystocarp; it is 915μ long, 858μ broad and upwards only 286μ.

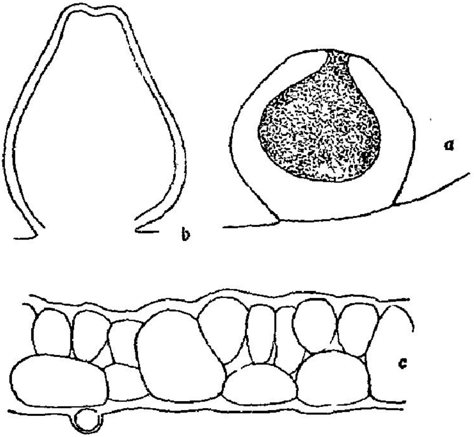

Fig. 7.—*a*, cystocarp of *Champia globulifera* Boergs. *b*, cystocarp of *Champia salicornoides* Harv.; *c*, transverse section of the wall of *Champia globulifera*. *a* and *b*. × 35; *c* × 200.

The Indian plant seems also to show much likeness to *Champia Kotschyana* Endl. et Dies., a plant which I only knew from descriptions. The latter agrees with *Champia globulifera* in having globose cystocarps, but if KÜTZING's figures (Tab. Phycol., vol. 15, pl. 91, figs. a, b) give a correct picture of the plant, its articulations are much shorter and it does not seem to be so densely branched as *Champia globulifera*. Of how many layers of cells the wall is built is not mentioned in the description.

3. **Champia compressa** Harv., The genera of South African Plants, Cape Town 1838, p. 402; Nereis Australis, London 1847, p. 78, tab. XXX. J. AGARDH, Spec., Alg., p. 370; Epicrisis, p. 305. For more literature and synonyms, see DE-TONI vol. IV, p. 561.

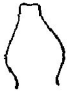

Fig 8.—*Champia compressa* Harv. Outline of a cystocarp. × 12.

Of this fine plant I have collected several tetrasporic specimens. The tetrasporangia are formed over the whole surface. In IYENGAR's collection a few dried female specimens are found. Fig. 8 shows the outline of a cystocarp; their shape agrees very

well with HARVEY'S figure. The cystocarp figured was 1.4 mm. long and 1 mm. broad.

India: Tuticorin, Hare Island, 29th February 1928, leg. M.O.P.I.

Distr.: Cape, Newcaledonia, Ceylon, Friendly Islands, Borneo, etc.

Fam. 2. *Rhodymeniaceæ.*

Sub-fam. 1. *Rhodymenieæ.*

Coelarthrum Boergs.

1. Coelarthrum opuntia (J. Ag.) Boergs. nov. comb.—*Chondria opuntia* J. Ag., in Linnæa, 1841, vol. 15, p. 21. *Lomentaria* (?) *opuntia* J. Ag., Spec. Alg. vol. II, p. 737. KYLIN, Die Florideengattung Rhodymeniales (Lunds Universitets Aarsskr. N. F. Avd. 2, vol. 27, 1931, p. 33, tab. 20, fig. 48). *Gastroclonium opuntia* (J. Ag.) Kütz., Spec. alg., p. 866. *Chrysymenia opuntia* Endl., Gen. Pl., Supplem. III, p. 42. WEBER VAN BOSSE, Alg. Siboga, p. 468.

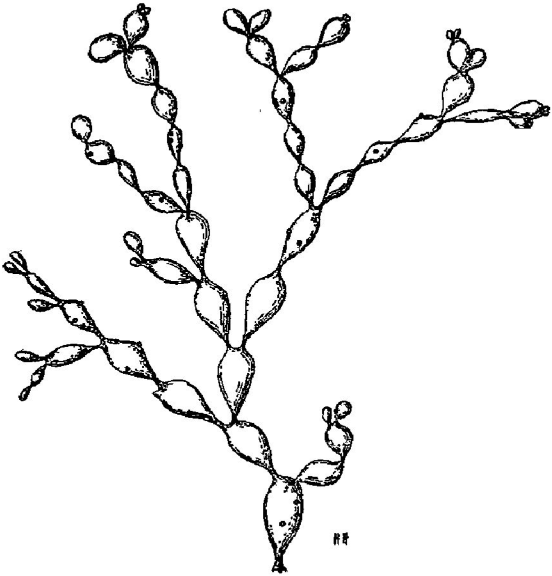

Fig. 9.—*Coelarthrum opuntia* (J. Ag.) Boergs. Habit of a cystocarpic specimen. Natural size.

As will be seen from the quotation given above, this plant has been referred to several genera. J. AGARDH at first considered it to be a *Chondria*, then a *Lomentaria* though with a query. KÜTZING refers it to his genus *Gastroclonium* and Mme. WEBER joins ENDLICHER in placing it in the genus *Chrysymenia*. Mme. WEBER gives a description of the plant accompanied by a transverse section of a cystocarp and writes that it cannot be a *Lomentaria* but a *Chrysymenia*. She points out though that in several respects the plant reminds one of the genus *Coelarthrum*. Finally KYLIN has examined the original specimen in J. AGARDH's herbarium ; he points out that by means of this specimen he was unable to decide its systematic position and adds : " Unmöglich ist aber nicht, dass sie sich am nächsten den Gattungen *Erythrocolon* und *Coelarthrum* anschliesst." KYLIN found that the wall of the vesicles is composed of 2-3 layers of large cells covered by a cortical layer of small cells. Rhizoids are not present and gland cells were not observed.

From an examination of a fine female, but dried, specimen in IYENGAR's collection, it seems evident to me that this plant belongs to the genus *Coelarthrum*. In material soaked in water, it was found that on the wall of the large cells facing the cavity of the inflated joints of the thallus, gland cells occur placed on irregularly shaped or stellate cells (Fig. 10 b) quite in conformity with those found in the type species of this genus, *Coelarthrum Albertisii* (compare my figures 390 and 391 in Mar. Alg. D. W. I. vol. II, p. 404-6). A transverse section (Fig. 10 a) of the wall shows it to be composed of about two layers of large cells, the larger ones innermost and covered by a dense layer of cortical cells. The arrangement of the cystocarps is quite similar to that of *C. Albertisii* (compare my figure 389 B.)

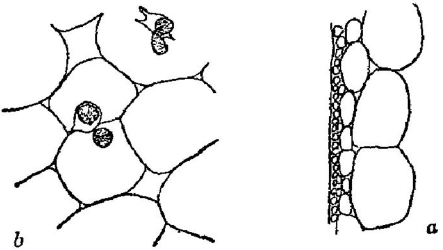

Fig. 10.—*Coelarthrum opuntia* (J. Ag.) Boergs. *a*, transverse section of the thallus; *b*, big cells of the wall with small irregularly stellate cells carrying glands. (About × 125).

Coelarthrum opuntia is surely closely related to *Coelarthrum Muelleri* (Sond.) Boergs. (in Kew Bull. 1931, no 1, p. 9, fig. 6-7), but nevertheless easily distinguishable from this plant by

its smaller thallus, its shorter and proportionately broader segments and in its more delicate structure in all respects. Thus a transverse section of the thallus shows that the wall of *C. opuntia* is composed of 1-2 layers of large cells generally covered by a single layer of cortical cells, whereas *C. Muelleri* has 2-3 layers of large cells and a cortical layer of two or more layers. Finally the innermost large cells in *Coelarthrum Muelleri* are almost twice as big (about 375μ long) as those in *Coelarthrum opuntia* (about 200μ long). If well preserved material (in alcohol) of *C. opuntia* were available it might perhaps be possible to find out other differences also for distinguishing the two plants.

India: Tuticorin, 16 Oct. 1900 a female plant leg. K. RANGACHARY; Danushkodi, Oct. 1922, a sterile specimen, "washed ashore" leg. M. O. P. I.

Distr.: India, Malayan Archipelago.

Botryocladia (J. Ag.) Kylin.

1. Botryocladia leptopoda (J. Ag.) Kylin.

Forma LUXURIANS Boergs. Some Mar. Alg. Arabian Sea, p. 39, where literature is quoted.

In IYENGAR'S collection some fine specimens of this stately plant are present. They agree very well with those found by me at Dwarka. The specimens are about 30 cm. high. The vesicles are pyriform-globose in shape and vary very much in size; they are about 2-4 mm. broad. The wall of the vesicles is about 65μ thick and consists of one layer of large cells covered by a cortical layer one to two cells thick.

India: Cape Comorin, Sept. 1924, leg. M. O. P. I.

Distr.: Arabian Sea, Malayan Archipelago, Japan, Australia.

VI Ceramiales.

Fam. I. ***Ceramiaceæ.***

Sub-fam. I. ***Spermothamnieæ.***

Spermothamnion Areschough.

1. Spermothamnion spec.

A sterile *Spermothamnion* forming tufts 2-3 cm. high is found in IYENGAR'S collection. Its creeping basal filaments are fixed to the substratum with unicellular rhizoids ending in a broad disc with coralliform outline. The cells in the basal filaments are 80 μ broad and about 150 μ long. The erect filaments are about 70 μ broad and the cells have a length of about 190 μ. Upwards the filaments are irregularly ramified.

India: Cape Comorin, Oct. 1924, leg. M. O. P. I.

Sub-fam. 2. *Monosporeæ.*

Pleonosporium Naegl.

1. **Pleonosporium Borreri** (Engl. Bot.) Naegl., Beitr. zur Morphologie u. System. der Ceramiaceæ, 1861, p. 342. HAUCK, Meeresalgen p. 87.—*Conferva Borrri* Engl. Bot., tab. 1741. For more synonyms compare DE-TONI, Syll. Alg. p. 1303.

The Indian plant of which I have had only very little material seems to agree very well with this species, but nevertheless I think that a short description of the Indian plant accompanied by a few figures might be of some use.

The plant forms small dense tufts (on stones ?) upto about 2 cm. high. The base (Fig. 11a) consists of the lower decumbent parts of the filaments and is fixed by means of rhizoids to the substratum. Such rhizoids are also now and then developed higher up in the filaments (Fig. 11c) and when they come into contact with a suitable substratum may be able to produce new plants.

In the lower decumbent part, the filaments are moniliform and are not very thick, but become thicker and cylindrical upwards. The main filaments have a breadth of about 140-200 μ with thick walls. In the basal part, the cells are about as long as broad, but higher up in the filaments they are about 2-3 times as long as broad.

In the lower parts of the filaments the branches are placed in a spiral manner (Fig. 11 b.) and are given out on all sides. Higher up they are more or less alternately placed in two rows one on either side of the main filaments (Fig. 11 c.) Some of the branches are ramified from near the base, some are more or less unbranched or form at their upper ends a few short oppositely placed ramuli (Fig. 11 d.) As a rule the branchlets are somewhat incurved, especially in the upper part of the thallus, enclosing the young parts of the thallus with their upper ends.

The only kind of fructiferous organs found are polysporous sporangia (Fig. 11 e) which contain a very large number of spores (about 12-20). The sporangia are placed in rows on the upper ventral side of the filaments near their base. They are oval-obovate in shape, about 60 μ broad and 75 μ long. Their wall is about 5 μ thick.

India: Pamban, April 1924, leg. M. O. P. I.

Distr.: Warm Atlantic coast of Europe, Mediterranean Sea, China.

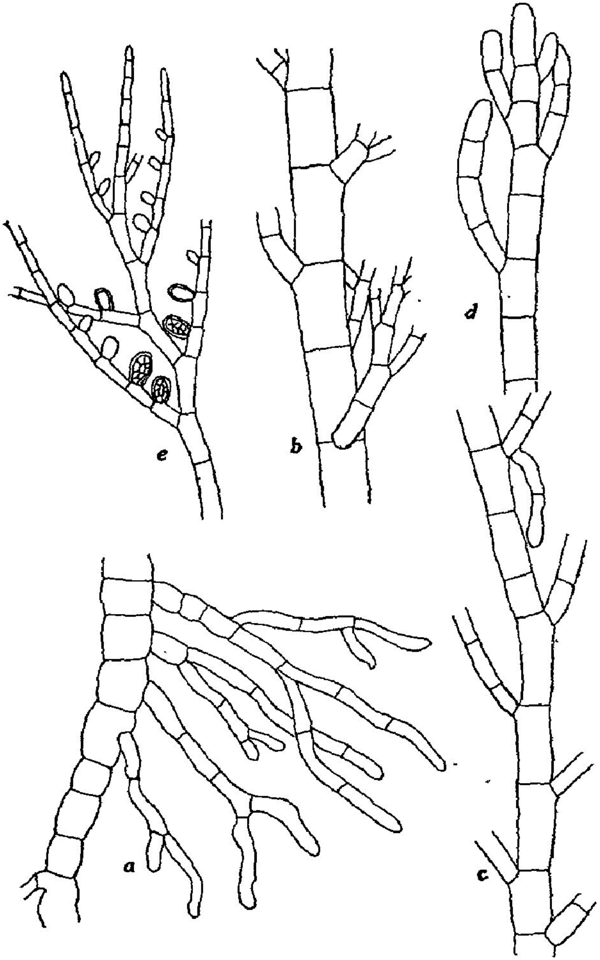

Fig. 11.—*Pleonosporium Borreri* (Engl. Bot.) Naegl. *a*, base of a filament; *b*, lower part of a filament; *c*, part of a filament higher up; *d*, upper end of a filament; *e*, ramified part of the thallus with polyspores. *a*, *c*, *e*. × 80 ; *b*, *d*. × 125.

Sub-fam. 3. ***Wrangelieæ.***

Wrangelia C. Ag.

1. **Wrangelia Argus** Mont., Sylloge generum specierumque Cryptogamarum, Paris 1850, p. 444. Boergesen, Mar. Alg. D. W. I., vol. II, p. 116. Okamura, Icones Japan. Algae, vol. V, 1934, p. 46, pl. 324.—*Griffithsia Argus* Mont. in Webb et Berthelot, Hist. nat. des iles Canaries, vol. III, sect. III, Paris 1830-50, p. 176, tab. 8, fig. 4. *Wrangelia plebeja* J. Ag., Spec. Alg., II, 3, 1863, p. 707; Epicrisis, 1876, p. 623.

Several gatherings containing tetrasporic and male specimens are found in Iyengar's collection. In my West Indian and Canarian material the rhizoidal layer surrounding the large cells in the filaments was not much developed. But in the Indian specimens the decumbent rhizoids originating from the basal cells of the short shoots in the older parts of the thallus formed a thick but rather loose covering round the large cells. Okamura (l. c.) gives a good figure of the development of this rhizoidal covering, and his figure 6 shows a transverse section of a cell with a thick covering of rhizoids. Like the Japanese plant (compare Okamura's fig. 1) the Indian plant was rather large, a good deal larger than those found by me.

India: Krusadi Island, Pamban, Oct. 1924 and Sept. 1928, leg. M. O. P. I.

Distr.: West Indies, Canary Islands, Malayan Archipelago, Japan.

Sub-fam. 4. ***Spyridieæ.***

Spyridia Harv.

1. **Spyridia fusiformis** nov. sp. Thallus cæspitosus, corticatus, teres, articulatus, in media parte thalli submoniliformis, ca. 6-7 cm. altus et 1 mm. latus, ad apicem versus gradatim attenuatus, irregulariter ramosus. Rami sparsi, quoquoversum vage egredientes, fusiformes, breves aut plus minus elongati. Articuli ramorum diametro duplo vel triplo breviores. Ramelli sparsi nullo ordine egredientes, articulati, ad genicula leviter corticati, tenuissimi, piliformes et mox decidui, ca 1 mm. longi et ca 25μ lati, ex articulis diametro ca 2-3 plo longioribus, apice frustuloso, 2-3 cellulis parvis subconicis instructo compositi.

India: Krusadi Island, Pamban, Oct. 1924, leg. M.O.P.I.

The few tufts found in the collection reached a height of about 6-7 cm. The base consists of a flat disc from which a number of erect shoots arise. The thallus is terete and articulate,

the main stems becoming moniliform in their lower part. The main filaments have a diameter of about 1 mm. or a little more and the distance between the articulations in the lower parts

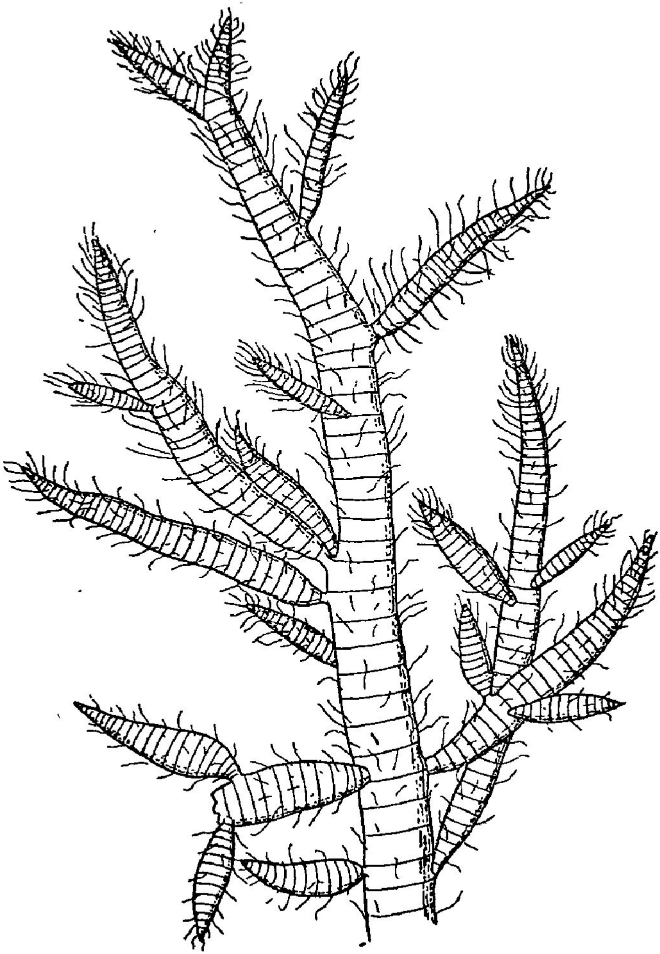

Fig. 12.—*Spyridia fusiformis* Boergs. Part of the thallus. × 8.

is about half the breadth of the filament, but in the upper parts and in the ramuli it is about 1/3-1/4 only. The cortical layer (Fig. 14) consists of elongated cells placed irregularly in the direction of the stem. The lower parts of the main filaments are not or only rarely branched, but they get much branched upwards. The ramification is quite irregular, branches and branchlets being given off on all sides. A few of the branches grow out like main filaments and are not or only very little constricted at their bases, but generally most of the lateral branches have only a limited growth. These are fusiform in shape, short or long, and very much constricted near the base and tapering from the middle towards the acute apex (Fig. 12).

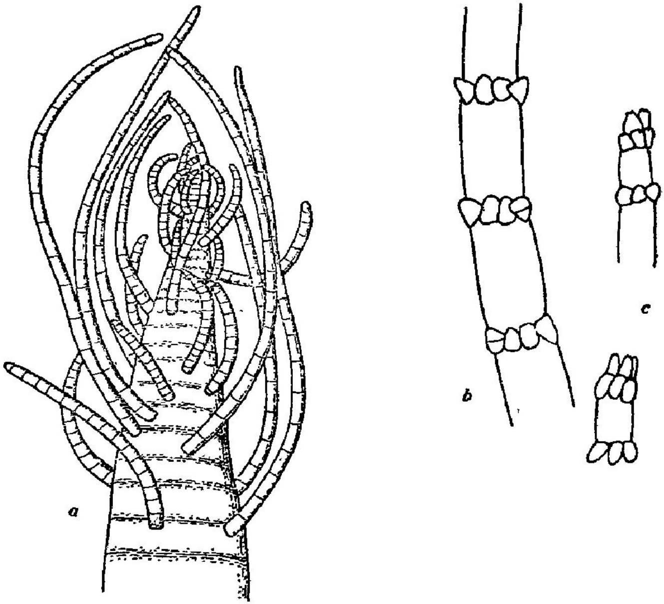

Fig. 13.—*Spyridia fusiformis* Boergs. a, apex of thallus with ramelli; b, part of a ramellus with the cortical annulations; c, summits of ramelli. a, about × 85, b,c about × 250.

The ramelli (Fig. 13) are given out on all sides and are placed very irregularly, young ones growing out between the older ones. They are very thin and ephemeral, dying away early so that the older parts of the thallus become bare. They are often

rather long (more than 1 mm. long), but only 25μ thick; the cells are about 250μ long. The cortical annulation at the crosswalls is generally composed of only a single row of cells, now and then some of the cells become divided into two cells (Fig. 13, b). In the upper ends a few, 2-3, rather large thick-walled cells are found provided at their upper ends with some quite small protuberances (Fig. 13, c), but no hooks are present.

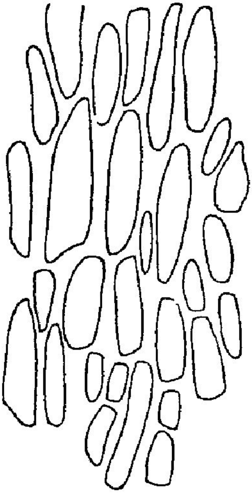

Fig. 14.—*Spyridia fusiformis* Boergs. Part of the cortical layer. × 400.

On account of its thin feeble ramelli, this species shows some likeness to some forms of *Spyridia filamentosa* and related species, but it differs especially in the markedly fusiform shape of the branches, in the irregular arrangement of the cortical layer and in the ramelli having no spines.

2. Spyridia insignis J. Ag., Spec. II, p. 344; Epicrisis, p. 272.—*Spyridia ericoides* Kütz. in Bot. Zeit. 1847; p. 37. Spec., p. 668; Tab. Phycol., vol. XII, tab. 52 a-b. *Spyridia tetracantha* Kütz., Tab. Phyc., vol. XII, tab. 52 d, e. *Bindera insignis* J. Ag., Adversaria, p. 36.

A few specimens are to be found in the collections examined by me.

India: Cape Comorin, Sept. 1920 and 1924, M.O.P.I. Trivandrum, Travancore, Jan. 1934, leg. E. K. JANAKI and E. W. ERLANSON.

Distr.: India, Cape, Dar es Salaam.

Fam. 2. **Delesseriaceæ.**

Sub-fam. 1. **Delesserieæ.**

Caloglossa Harv.

1. **Caloglossa Leprieurii** (Mont.) J. Ag., Epicrisis, p. 499. ERIKA POST, Systematische und pflanzengeographische Notizen zur *Bostrychia-Caloglossa*-Association (Revue algologique, vol. 9, p. 51).—*Delesseria Leprieurii* Mont., in Ann. Sc. Nat., Bot., sér. 2, vol. 23, p. 196, tab. V. fig. 1.

A narrow form among which a few filaments of a sterile *Spirogyra* was present in IYENGAR'S collection. The thallus reached a breadth of up to about 800μ, which is a little broader than the measure given by MISS POST for her forma *pygmaea*. A few tetrasporic bits of the thallus were found, but most of the material was sterile and apparently in active vegetative division.

India: Quilon in Travancore in the brackish backwater, growing attached to small stones, Oct. 1924, leg. M.O.P.I.

Distr.: Widely distributed in warm seas.

Sub-fam. 2. **Nitophylleæ.**

Nitophyllum Grev.

1. **Nitophyllum marginale** Harv. in KÜTZING, Tab. Phyc., XIX, p. 2. HARVEY, Ceylon Alg. No. 26. KYLIN, Studien über Delesseriaceen, p. 76.—*Aglaophyllum marginale* Kütz., l. c., pl. 5.

A single young sterile specimen is found in IYENGAR'S collection. It is quite like the specimens gathered by me at Galle.

India: Tuticorin, March 3rd 1928, leg. M.O.P.I.

Distr.: Ceylon.

Acrosorium Zanard.

Acrosorium uncinatum (J. Ag.) Kylin, Studien über die Delesseriaceen p. 78, fig. 61.—*Nitophyllum uncinatum* J. Ag., Spec. Alg., II, p. 654. *Cryptopleura lacerata* var. *uncinata* Kütz., Tab. Phyc., vol. 16, tab. 25 e. *Fucus laceratus* var. *uncinatus* Turn., Hist. Fucorum, tab. 68, figs. c-d.

Some sterile specimens preserved in formalin are found in IYENGAR's collection.

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Distr.: Warm Atlantic European Coast, Canary Islands, Mediterranean Sea, Cape, Malayan Archipelágo, Japan.

Sub-fam. 3. Sarconemieæ.

Claudea Lamour.

1. **Claudea multifida** Harv. in Hooker Journ. of Bot., vol. VI, p. 145; Ceylon Algæ No. 2. KÜTZING, Tab. Phyc., vol. 19, pl. 56.

India: Tuticorin, March 3rd 1928, leg. M.O.P.I.

Distr.: Ceylon, South-India.

Vanvoorstia Harvey.

1. **Vanvoorstia spectabilis** Harv. in HOOKER, Journ. of Bot., vol. VI, p. 144; Ceylon Alg. Exsicc. no 3. KÜTZING, Tab. Phycol., vol. 19, tab. 56. WEBER VAN BOSSE, A., Algues Siboga, p. 390, fig. 141.

A few small sterile specimens are found in IYENGAR's collection.

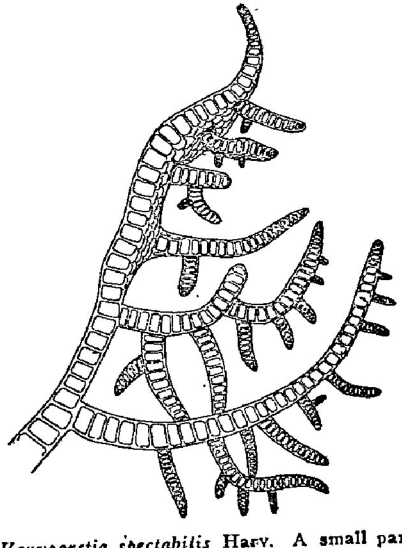

Fig. 15.—*Vanvoorstia spectabilis* Harv. A small part of the young thallus, compare the text. × 50.

In Fig. 15 a small part of the young thallus is drawn to show how it is built. In contrast to *Claudea* the branchlets forming the net are given out from the underside of the branches of first order whereas in *Claudea* they issue from the upper side of the branches. Furthermore, the meshes of the net are oblique in *Vanvoorstia* (not so clearly seen in the figure), whereas they are rectangular in *Claudea*.

India: Shingly Island, Pamban "on coral stone", May and Oct. 1920, leg. M. O. P. I.

Distr.: Ceylon, Malayan Archipelago, Japan, Hawaii.

Martensia Hering.

1. **Martensia fragilis** Harv. in HOOKER, Journ. Bot., vol. 6, p. 145: Ceylon, Alg. exsicc. no. 5.

Some rather small, sterile specimens found in IYENGAR'S collection certainly belongs to this species. As pointed out by SVEDELIUS in his valuable publication on *Martensia*, the non-reticulate part of the thallus is as a rule much developed before the net begins to grow out, and this was also the case in the two Indian specimens.

India: Shingly Island, Pamban, Oct. 1924, leg. M.O.P.I.

Distr.: Ceylon.

Fam. 3. *Dasyaceæ*.

Heterosiphonia Mont.

1. **Heterosiphonia stuposa** (J. Ag.) De-Toni, Syll. Alg. p. 1235.—*Dasya stuposa* J. Ag., Sp. Alg., II, 3, p. 1197. Till Algernes Systematik, Nya Bidrag XI, Florideæ, 1890, p. 86.

Like *Heterosiphonia Muelleri* (compare my description in Kew Bulletin, 1931, p. 18) this species has a thick, fleshy-cartilaginous, irregularly ramified, terete base fixed firmly to the substratum. From this base, which is most probably perennial, erect shoots issue, living, as I presume, during the favourable season only. In the few specimens I have seen, the erect shoots reach a length of about 9 cm. They have no cortical layer, and near the base they are about 1 mm. thick with barrel-shaped segments composed of 9-11 pericentral cells round the central cell. AGARDH in "Species" says 7-9 pericentral cells, but in "Till Algernes Systematik" corrects it to 11. The free ends of each branch system of the sympodium are a little more than 1 cm. long and issue alternately in two rows on either side of the main filament giving the whole shoot-system a pinnate appearance. They are provided with short pinnules, about ½ mm. long, which are branched a few times and which end in long, repeatedly forked monosiphonous filaments which are about 30 μ thick near the base decreasing to about 10-11 μ thick at the upper ends.

The specimens were sterile.

I compared the Indian plants with some of FERGUSON's specimens from Ceylon at the British Museum (Nat. Hist.), London. The Indian plants agree very well with those from Ceylon.

India: Tuticorin, Pearl Bed, March 1928, M.O.P.I.

Distr.: Ceylon.

Dasya C. Ag.

1. Dasya Iyengarii sp. nov.

Frons nana, ca. 3 cm. alta, epiphytica, mollissima, leviter corticata, penicillato-villosa, irregulariter ramosa. Penicilli quoque versum exeuntes, ca 500-600 μ longi, monosiphonii, interdum in parte basali plurisiphonii, sursum leviter attenuati, squarroso-subdichotomi, ramellos valde incurvos, hamosos, apicibus subobtusis gerentes. Stichidia oblonge-lanceolata, apicibus subacutis, ca 500 μ longa et 100 μ lata.

India: Pamban Bridge, May 1924, leg. M.O.P.I.

The plant forms small dense, soft, much ramified tufts on *Gelidiopsis variabilis* (Fig. 16). The tufts are about 3-4 cm. high, and

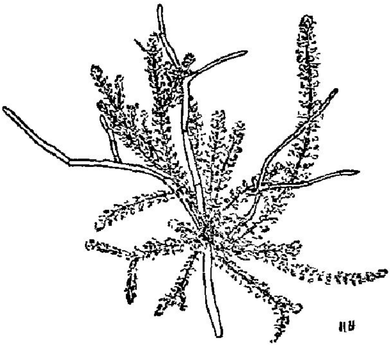

Fig. 16.—*Dasya Iyengarii* Boergs. Habit of a small plant epiphytic on *Gelidiopsis variabilis*. × 3.

the only dried specimen seen by me has a dark brown to red colour. The thick main stems are about 300 μ thick, tapering upwards to about 150-200 μ. The stems consist of a central and 5 pericentral cells. The cortical layer is feebly developed consisting only of rhizoids running down along the furrow between the pericentral cells (Fig. 17). The penicilli are given out in a scattered manner on all sides. They are generally purely monosiphonous, though now and then in the most vigorously growing portions

a few polysiphonous segments are found at the base. Occasionally a branch becomes developed instead of a penicillus. The penicilli are subdichotomously divided (as to the real building up of the penicillus compare FALKENBERG, Rhodomelaceen, p. 611), reaching a length of 500-600 μ and completely envelop the main stems. The ramuli are much curved and hook-shaped (Fig. 17).

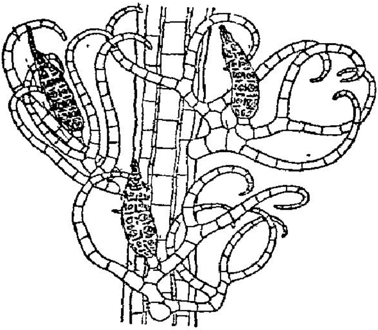

Fig. 17.—*Dasya Iyengarii* Boergs. Part of the thallus with stichidia. × 50.

Near the base, the penicilli are about 80-90 μ thick tapering slowly upwards. The apex is obtuse. The stichidia are oblong-lanceolate, tapering upwards and as a rule provided with a sterile short filament ending monosiphonously (Fig. 17). The dried specimen adheres strongly to paper.

Dictyurus Bory.

1. **Dictyurus purpurascens** Bory in Belanger, Voyage Ind. orient., tab. I, p. 170 (after DE-TONI). J. AGARDH, Spec. Alg., II, 3. p. 1245. FALKENBERG, Rhodomelaceen, p. 675, tab. 17, figs. 10-24.

The first specimens which were described of this plant were gathered by BELANGER at Cape Comorin. The plant is common at Tuticorin. The specimens examined by me were sterile.

India: Tuticorin, Hare Island, Oct. 1923, M.O.P.I.; March 1929(!).

Distr.: Indian Ocean.

Fam. 4. **Rhodomelaceæ.**

Sub-fam. 1. **Laurencieæ.**

Laurencia Lamx.

1. Laurencia papillosa (Forssk.) Grev., Alg. Brit., p. 52. J. AGARDH, Spec. Alg. II, p. 756. KÜTZING, Spec. Alg. p. 665 and Tab. Phyc. vol. XV, pl. 62. BOERGESEN, Mar. Alg. D. W. I., p. 246, fig. 236. YAMADA, Notes on *Laurencia*, p. 190.—*Fucus papillosus* Forssk., Fl. Ægypt.-Arab., p. 190.

Several well developed specimens are present in IYENGAR'S collection.

India: Tuticorin, Febr. 1928, leg. M.O.P.I.; Krusadi Island, Pamban, May 1924, leg. M.O.P.I.

Distr.: Warm Atlantic Ocean, Mediterranean and Red Seä, Indian Ocean, etc.

2. Laurencia indica Hauck in Hedwigia, vol. 27, 1888, p. 90. YAMADA, Y., Notes on *Laurencia*, p. 205, fig. I, pl. 6, fig. b.

In IYENGAR'S collection some tetrasporic specimens preserved in formalin seem to agree very well with HAUCK'S description. Lenticular thickenings were found in the medullary tissue. I have not been able to compare the specimens with authentic material.

India: Tuticorin, leg. M.O.P.I.

Distr.: East Africa.

3. Laurencia ceylanica J. Ag., Epicrisis, p. 660.—*Laurencia* spec. HARVEY, Alg. Ceylon, no 17. YAMADA, Notes on *Laurencia*, p. 244, pl. 30, fig. a.

A fine large specimen collected in Sept. 1924 is found in IYENGAR'S collection, another one collected in April of the same year is quite small.

India: Cape Comorin, Sept. 1924, Krusadi Island, April 1924, leg. M. O. P. I.

Distr.: Ceylon, Shikoku (after YAMADA). Hawaian Islands according to a specimen in the Botanical Museum, Copenhagen, and determined by REINBOLD.

Sub-fam. 2. **Chondrieæ.**

Chondria Ag., Harv.

1. Chondria dasyphylla (Woodw.) Ag., Spec. Alg., p. 350; Systema, p. 205. HARVEY, Nereis Bor.—Am. II, p. 20. FALKENBERG, P., Rhodomelaceen, p. 197, pl. 22, figs. 4-18.—*Fucus dasyphyllus* Woodw., in Transact. Linnean Soc., vol. II, 1794, p. 239, pl. 23, figs. 1-3.

Male and female specimens like my figures 251 and 252 in Mar. Alg. D. W. I., vol. *II*, p. 258 are *found in* IYENGAR's collection. The specimens were epiphytes on leaves of a sea-grass.

India: Krusadi Island, April 1924, leg. M.O.P.I.

Distr.: In most warm seas.

2. **Chondria armata** (Kütz.) Okamura, Icones Jap. Alg., vol. I, pl. 16, figs. 9-19. WEBER VAN BOSSE, Alg. Siboga p. 353.—*Lophura armata* Kütz., Tab. Phyc. vol. XVI, tab. 3, figs. a,b. *Rhodomela crassicaulis* Harv., Alg. Ceyl. exsicc. no 8. SVEDELIUS in Botaniska Studier tillägnade F. R. KJELLMAN, p. 191, figs. 3 and 9. *Chondriopsis crassicaulis* J. Ag., Analecta Algologica, 1892, p. 161. *Chondria minima* Weber, Alg. Siboga, p. 309, pl VII, fig. 9.

Var. PLUMARIS Boergs. in Kew Bull. no 3, 1932, p. 132-4.

India: Tuticorin, Hare Island, March 1928, (!) Pearl Bed, Febr. 1928, leg. M.O.P.I. Pamban Bridge, April 1924, leg. M. O. P. I. Trivandrum, Travancore, Jan. 1934, leg. E. K. JANAKI and E. W. ERLANSON.

Distr.: Ceylon, India, Malayan Archipelago, Japan, etc.

Acanthophora Lamx.

1. **Acanthophora muscoides** (L) Bory. Voyage Coquille, p. 51. J. AGARDH, Species, II, 3, p. 816.—*Fucus muscoides* L., Spec. plant. II, p. 1630.—*Chondria muscoides* Ag., Spec., p. 361.

In some material gathered by IYENGAR, tetrasporic specimens were found. The tetrasporangia occurred in almost unaltered branchlets densely covered by spines, scattered spines being also present on the branches. Because of these characters the specimens must be referred to *Acanthophora muscoides*. As I have pointed out in earlier papers on algæ from India, my material was in most cases sterile, and therefore my referring of the specimens to *Acanthophora Delilei* is perhaps not correct.

India: Tuticorin, Oct. 1923, leg. M.O.P.I.

Distr.: West Africa, Cape, Japan, Fidschi-Islands, Brazil, West Indies, etc.

2. **Acanthophora spicifera** (Vahl.) Boergs., Mar. Alg. D. W. I., vol. II, p. 259, figs. 253-8. WEBER, A., Algues Siboga, p. 347.—*Fucus spiciferus* Vahl, Endeel kryptogamiske Planter fra St. Croix (Skrivter af Natur historie-Selskabet, 5. Bd., Koebenhavn 1802. *Acanthophora Thierii* Lamx., Essai........ Thalassiophytes, Paris 1813, p. 44. J. AGARDH, Spec. Alg., vol. II, 3, p. 819.

Some specimens found in IYENGAR's collection are referable to this species.

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Distr.: West Indies, Malayan Archipelago, Ceylon.

Sub-fam. 3. ***Polysiphonieæ.***

Polysiphonia Grev.

Polysiphonia platycarpa Boergs. in Kew Bulletin, 1934, p. 33, figs. 15-17; List Mar. Alg. Bombay, p. 60.

Several dried specimens are found in IYENGAR's collection; the cystocarps in a female plant were about 400μ long and broad.

In the last paper quoted above, I have pointed out that this species is closely related to or perhaps the same as *Polysiphonia mollis* Hook. et Harv.

India: Madras, Adyar estuary near Bridge, in brackish water, leg. M.O.P.I.

Distr.: India.

Bryocladia Schmitz.

1. Bryocladia Thwaitesii (Harv.) De-Toni, Syll. IV, 968.— *Polysiphonia Thwaitesii* Harv., Ceylon Alg. no 15. MURRAY, Catalogue, p. 31. KÜTZING, Tab. Phycol. XIV, tab. 46, fig. d-g.

The plant grows in dense tufts about 4-5 cm high. The base consists of decumbent creeping filaments felted together. These filaments are fixed to the substratum by means of vigorous unicellular rhizoids ending in a flat disc with irregular outlines. The decumbent creeping filaments are ramified and after some time bend upwards giving rise to erect shoots.

The basal filaments as well as the erect ones are quite without any cortical layer. The plant has a varying number of pericentral cells, up to about 11 in the vigorous filaments. The erect filaments have monopodial growth. In the lower part they are quite unbranched or nearly so with several bare segments between those that carry branches, higher up they become densely ramified, branches being given out from almost every segment. The branches are placed in a spiral to the left.

The branches are ramified several times in the same way. There are no or only a few branches in the lower parts, higher up they are placed more densely. The side branches are often unbranched and spine-like or provided with a few spine-like branchlets at their upper ends. The branchlets curve more or less towards the main axis.

Only specimens with tetrasporangia are found. The tetrasporangia are found in the upper spine-like branchlets, one in each segment and in a straight line.

India: Madras, Rayapuram Beach, Aug. 1926, leg. M.O.P.I.

Distr.: Ceylon.

Roschera Sond.

1. **Roschera glomerulata** (Ag.) Web. v. Bosse, Rhodophyceæ Percy Sladen Trust Exp. (1914) p. 289; Liste Alg. Siboga, p. 359. OKAMURA, Icones Jap. Alg. vol. IV, (1922), p. 155, tab. 188. BOERGESEN in Kew Bulletin 1931, p. 17, fig. 11.—*Hutchinsia glomerulata* C. Ag., Spec. Alg. II, p. 102. *Tolypocladia glomerulata* Schmitz in Engl. Bot. Jahrb. vol. 21, p. 160. *Falkenberg*, Rhodomelaceen, p. 177 tab. 21, figs. 27-29.

Fine tetrasporic specimens were found. As described by FALKENBERG, one or two tetrasporangia are formed in the branchlets.

India: Krusadi Island, April 1926, leg. M.O.P.I.

Distr.: Indian and Pacific Oceans.

Sub-fam. 4. *Lophothalieæ.*

Lophocladia Schmitz.

1. **Lophocladia Lallemandi** (Mont.) Schmitz, Die Gattung *Lophothalia* J. Ag. in Ber. d. deutsch. bot. Ges., XI, p. 223. FALKENBERG, Rhodomelaceen, p. 552. BOERGESEN, in Kew Bull. 1934, p. 28, fig. 19.—*Dasya Lallemandi* Mont., in Ann. Sci. Nat., Bot., 12, p. 289 (1849).

A badly preserved, sterile specimen was found in IYENGAR's collection.

India: Tuticorin, Pearl Bed, March 3rd 1928, leg. M.O.P.I.

Distr.: Mediterranean Sea, Red Sea, Indian Ocean.

Murrayella Schmitz.

1. **Murrayella periclados** (Ag.) Schmitz, Die Gattung *Lophothalia*. (Berichte d. deutsch. bot. Ges. XI, 1893, p. 227). FALKENBERG, Rhodomelaceen p. 563, pl. 12, figs. 24-25. BOERGESEN, Mar. Alg. D. W. I., vol. II, p. 314-6, figs. 318-20, where more literature.—*Hutchinsia periclados* Ag., Spec. Alg., vol. II, p. 101.

It was found together with *Caloglossa Leprieurii* and *Bostrychia tenella*, but as to locality there was no information. I have seen only sterile specimens.

India: Cannanore, leg. Miss F. SWAMIKANNU.

Distr.: Much distributed in warm seas.

Sub-fam. 5. **Bostrychieæ.**

Bostrychia Montagne.

1. **Bostrychia tenella** (Vahl) J. Ag., Spec. Alg., vol. II, p. 869. Analecta Algologica, cont. IV, 1897, p. 83. FALKENBERG, P., Rhodomelaceen, p. 515. BOERGESEN, Mar. Alg. D. W. I., vol. II, p. 300-2, figs. 299-302.—*Fucus tenellus* Vahl, Endeel kryptogamiske Planter fra St. Croix (Skrivter af Naturh. Selskab, 5te Bd., Kobenhavn 1802, p. 45).

Fine tetrasporic material is present in IYENGAR's collection In the vegetative parts of the thallus the filaments were altogether monosiphonous or nearly so, whereas in the fruiting parts they were shorter and polysiphonous in the lower half portion or even higher.

As regards the question of separating *Bostrychia Binderi* from *Bostrychia tenella* as a species of its own which has been done by MISS POST in her interesting paper, on the "*Bostrychia-Caloglossa*-Association",* I wish at first to point out that *Bostrychia Binderi* Harv. (Nereis Australis, p. 68, tab. 28, London 1847) must be said to differ very much from *Bostrychia Binderi* Post. In his description, HARVEY says "all the ultimate pinnules short and spinelike", and HARVEY'S Fig. 3 shows nothing but short polysiphonous branchlets whereas MISS POST says that above the polysiphonous part *Bostr. Binderi* has a monosiphonous part with 5-15 cells and that specimens with more than 15 cells are to be referred to *Bostr. tenella*. In my opinion this is quite an artificial limitation, and, as it is evident from MISS POST'S description also that the true *Bostrychia Binderi* Harvey is connected with transitional forms to *Bostrychia tenella*, I do not think it is right to separate it from VAHL'S species, though I think that it may be considered a variety of it. Agreeing with my observations in the West Indies as well as with the well known fact that many algæ are very much influenced by the surroundings, becoming long, thin and flabby in calm and polluted water, but robust and firm in exposed places with clean water, *Bostr. tenella* in the lagoons with stagnant and polluted water possesses long and monosiphonous branchlets, whereas in exposed places its branchlets become short. Of the different localities where I have collected this plant at the Virgin Islands, Great Northside Bay (Store Nordside Bugt), St. Thomas, is just such an exposed locality, and the plant reacts quite naturally to the external conditions found there and gets thicker, shorter and more robust branchlets. Because of this, MISS POST in agreement with her definition of the species refers the specimens I have collected there to *Bostrychia Binderi*. I have not come across in

* In Revue Algologique, vol. 9, 1936.

the West Indies any specimens resembling HARVEY'S true plant (without monosiphonous prolongations on the branchlets).

As mentioned by MISS POST (1. c., p. 25), GRUNOW, FALKENBERG and Mme. WEBER have treated this plant in quite the same way as myself. But PILGER also (Die Meeresalgen von Kamerun in ENGLER'S Bot. Jahrb. 46, Bd. 1911, p. 306) gives a very detailed description of his specimens showing that his material to a great extent agrees with forms which are referred by MISS POST to *Bostrychia Binderi* but are considered by PILGER to be *Bostrychia tenella.* PILGER writes : "Die Art ist (wohl auch nach den Standortsbedingungen) recht variabel".

India : Cannanore, leg. Miss J. Swamikannu.

Distr. : Much distributed in warm seas.

Sub-fam. 6. ***Herposiphonieæ.***

Herposiphonia Naegl.

1. Herposiphonia insidiosa (Grev.) Falkenberg, Rhodomelaceen, p. 317. OKAMURA, Icon. Jap. Alg. VI, p. 25, pl. 264, figs, 10-16. TSENG, Notes on mar. Alg. from Amoy, 1936, p. 60.— *Polysiphonia insidiosa* Grev. in J. Agardh, Spec. Alg., II, 3, p. 926.

As the species of *Herposiphonia* are often difficult to determine because of the incompleteness of the descriptions, these being generally based on sterile material, I wish to give a short description of a plant which I presume to be *Herposiphonia insidiosa.*

The plant forms a low dense felted cover on large algæ for instance *Gracilaria, Laurencia,* etc. As mentioned by OKAMURA and later by TSENG, the arrangement of the short and long shoots are not always so regular as for instance in *H. tenella* or *secunda* when typically developed. The long shoots are given out irregulary and often at rather variable distances, and the short shoots are placed more or less alternately in two rows often with several bare segments in between.

The decumbent main filaments are much ramified and fixed to the host plants by means of hapters which are often very vigorously developed and the unicellular stems of which may reach a breadth of up to 50-60 μ. The hapters often end in a flat disc with a coralliform, irregular outline, but it may also be unbranched or divided at the end into 2-3 branchlets. The decumbent main filaments are about 200 μ broad and composed of segments somewhat shorter than broad. The short shoots are much curved in the direction of the apex of the plant, they are about 80 μ broad and composed of varying numbers of segments, in the larger ones up to about 30, the length of the segments being about the same as the breadth or a little less. The apex is

obtuse. The number of pericentral cells varies very much. I have counted 8-12.

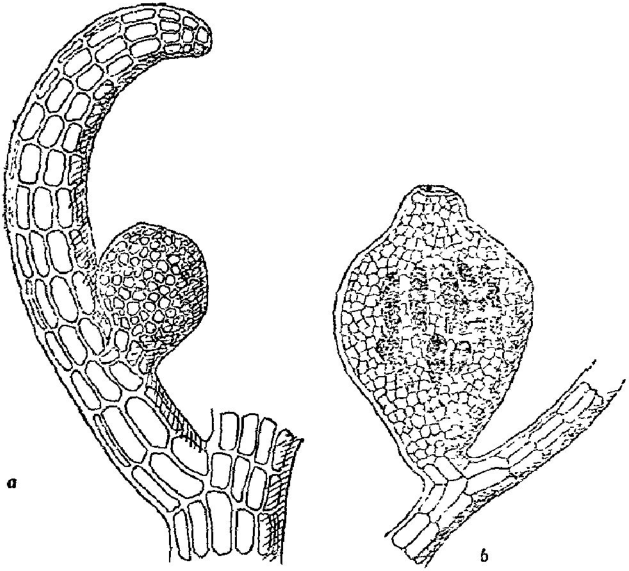

Fig. 18.—*Herposiphonia insidiosa* (Grev.) Falkenb. *a*, a short-shoot with young cystocarp. (× 250). b, a cystocarp. (× 75).

OKAMURA gives (l. c.) some figures of tetrasporic plants, but cystocarpic specimens do not appear to have been found so far. In a collection of IYENGAR's gathered in Oct. 1924 at Cape Comorin, female plants were found and the possibility was now present to decide whether the arrangement of the trichoblasts on the short shoots was spiral (as in *H. tenella*) or dorsiventral (as in *H. rostrata*); compare FALKENBERG l. c. p. 317. But because the trichoblasts are so rarely developed in this species, they seem almost only to be developed for the purpose of propagation, it was only after searching for a long time that I succeeded in finding a short young shoot containing a few very small trichoblasts. The fact that these are given off on different sides shows that the plant belongs to those with spiral arrangements.

As mentioned above, the trichoblasts are very small and often composed of an unbranched filament only; sometimes they

may be provided with a few short branchlets. Very few of the short shoots carry cystocarps and, so far as I have seen, each of these shoots have only a single one, very rarely two.

The cystocarps are developed near the base of the short shoots as a rule on the 3-4 segments from the base (Fig. 18a). Antheridial plants were not found.

The ripe cystocarps are large, about 500μ long and 370μ broad; they are elongated-urceolate and get narrow upwards and downwards (Fig. 18b).

India: Cape Comorin, Oct. 1924, and Pamban, April 1924, leg. M.O.P.I.

Distr.: India, Ceylon, China, Japan.

2. Herposiphonia spec.
=*Herposiphonia prorepens* forma Weber ?, Algues Siboga, p. 366.

A small sterile very much ramified *Herposiphonia* forming dense roundish tufts 1 cm. high and of the same breadth on *Amphiroa anceps* seems to agree very well with Mme. WEBER's description. The ramification of the Indian plant is the *typical* one of *Herposiphonia*. It has 6-11 pericentral cells. The short shoots vary very much in length. Near the periphery of the tufts they are about 270μ long and 20μ broad and composed of about 12-14 segments not so long as broad, whereas nearer the middle of the tufts the short shoots have a length of about 1 mm. and a breadth of about 90μ and are composed of about 20 segments which near the base are twice as long as broad gradually decreasing in length towards the apex, where they are only 1/5 to 1/4 as long as broad. The apex is broadly rounded. A few very small trichoblasts are found in the young short shoots. The decumbent creeping main filaments are about 150μ broad and the segments half the breadth. The short shoots all curve towards the apex. The colour of the plant seems to be lasting. It was found in a tube together with *H. insidiosa* in sea-water containing 6% of formalin and although the last mentioned plant had quite lost its colour this species had kept a dark brownish colour reminding one of that of tufts of *Sphacelaria*.

Mme. WEBER suggests that this may be made a new species, but since the plant is, like Mme. WEBER's, sterile, I agree with her in preferring to let it remain unnamed.

India: Cape Comorin, Oct. 1924, leg. M.O.P.I.

Sub-Fam. 7. ***Polyzonieæ.***

Leveillea Decsne.

1. Leveillea jungermannioides (Mart. et Her.) Harv.
Compare BOERGESEN, Contributions to a South Indian marine algal flora I, p. 389.

On an old piece of *Sargassum* some tetrasporic specimens were found. As pointed out by FALKENBERG, Rhodomelaceen, p. 398, fertile specimens of *Leveillea jungermannioides* are not often found. Generally fructiferous organs are found on small specimens whereas vigorously developed specimens are sterile. FALKENBERG points out that the branchlets in which the sporangia are developed compared with this plant otherwise so slender are almost enormous, and the sporangia too are of large dimensions up to about 200 μ broad. During growth, the fructiferous branchlets become much curved.

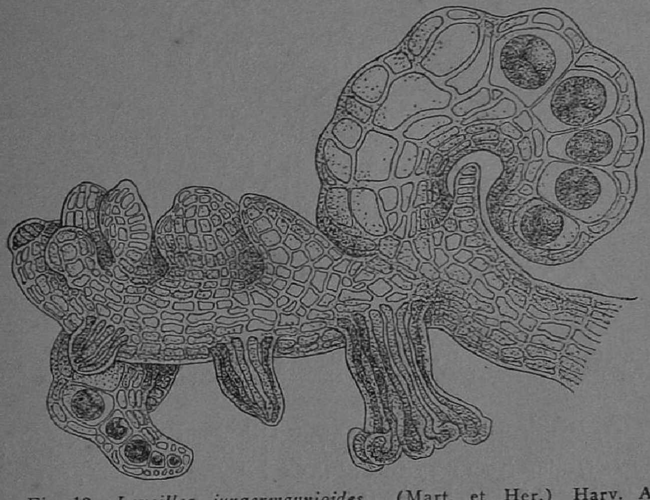

Fig. 19.—*Leveillea jungermannioides* (Mart. et Her.) Harv. A branchlet with stichidia. × 80.

The accompanying figure (Fig. 19) shows a small shoot of this elegant plant with such a much curved stichidium.

India : Shingley Island, June 24, leg. M.O.P.I.

Distr.: Red Sea, Indian Ocean, Australia.

Sub-fam. 8. ***Amansieæ.***

Enantiocladia Falkenberg

1. **Enantiocladia prolifera** (Grev.) Falkenb., Rhodomelaceen, p. 442.—*Amansia prolifera* Grev. in J. AGARDH, Spec. II, 3, p., 1116. *Dictymenia prolifera* Kütz., Spec., p. 848 ; Tab, Phyc. XIX, pl. 54.

Several fertile specimens with tetraspores and cystocarps are found in IYENGAR's collection. Some from Cape Comorin are most probably gathered near the shore and are dark red almost black and firm and robust. A few other specimens from pearl beds near Tuticorin thus gathered in deep sea have a rather thin thallus and are light red. Specimens with tetrasporangia were found in February, female ones in October.

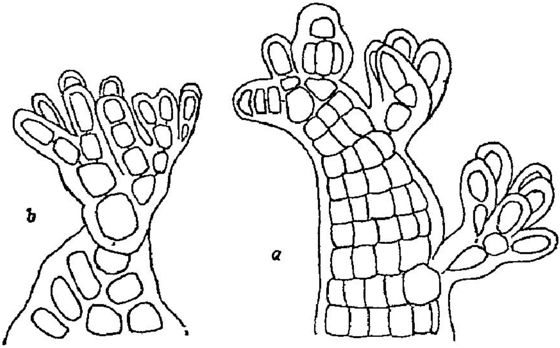

Fig. 20.—*Enantiocladia prolifera* (Grev.) Falkenb. *a*, a branchlet with trichoblasts, the second one from above showing the beginning of the development of the procarp; *b*, branchlet with trichoblast. × 250.

As mentioned by FALKENBERG (Rhodomelaceen, p. 440), *Enantiocladia* differs from *Vidalia* in the oppositely placed shoots issuing from the edges of the flat thallus. A few of these become long shoots, but by far most of them remain short. At the edges of these short shoots, small hooked branchlets (Fig. 20) of the last order are developed and upon these branchlets the trichoblasts are given out. Here and there adventitious branchlets of a similar shape issue from the flat parts of the thallus also. Generally the trichoblasts are developed in rows along the dorsal side of the branchlets, but often also without any order. All the trichoblasts seen by me in the female plants are quite small, being scarcely more than about 100μ high, having short cells with thick walls and being forked only a few times. The branches of the trichoblasts are from the very beginning free and not surrounded by a common cuticle as with the group *Amansieæ* or as with *Neurymenia*, compare my fig. 17 in Kew Bulletin 1933, p. 138. Like *Neurymenia* the fertile trichoblasts remain quite short forming only one undivided segment above the fertile one (Fig. 20a). A few, 2-4, rarely more, procarps are developed forming a row along the dorsal side of the branchlets. The trichogyne is

thick and proportionally short. After fertilization the cystocarps form a thick, dense cortical layer and become globose with a thick stalk. Generally only one of the procarps seems to be developed on the branchlet. The fully developed cystocarp has a diameter of about 600μ long or more. No ostiole is developed.

In the tetrasporic plant, the small curved branchlets of the third order are transformed into stichidia; furthermore, tetrasporangia are formed on the summits of the branches of the second order. Besides small trichoblasts like those found in the female plant, I found in the tetrasporic plant large well developed, and repeatedly forked trichoblasts having long cells with thin walls. Antheridial specimens were not present.

In Icones of Japanese Algæ, vol. I, pl. X, OKAMURA has given a series of figures of the fructiferous organs of *Enantiocladia latiuscula* (Harv.) Okam. with which those found in *Enantiocladia prolifera* (Grev.) Falkb. are to be compared.

India: Cape Comorin, Sept. 1924, and Tuticorin, Pearl Bed, 3rd Aug. 1928, leg. M. O. P. I.

Distr.: India.

Neurymenia J. Ag.

1. Neurymenia fraxinifolia (Mert.) J. Ag., Spec. Alg. II, p. 1135. Compare Boergesen, in Kew Bull., 1933, no. 3, pp. 137–142, figs. 17-20, where literature is quoted.

In the paper mentioned above, I have given some information about the development of the stichidia, cystocarps and antheridial bodies based upon material gathered at Tuticorin. There I have also pointed out that the varying shapes of the stichidia in plants from different localities might perhaps render it possible to divide this until now monotypic genus. I regret having omitted to mention that J. AGARDH (l. c.) has tried to make such a division especially because of the shape and size of the thallus.

India: Tuticorin, Hare Island, Febr. 1928, leg. M.O.P.I. and (!). Cape Comorin, Sept. 1924, and Krusadi Island, April 1924, leg. M.O.P.I.

Distr.: Indian Ocean, Japan, Australia, etc.